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73 Amateur Radio

Issue #314
A WCR Publication

Will my wife kill me if I buy this?

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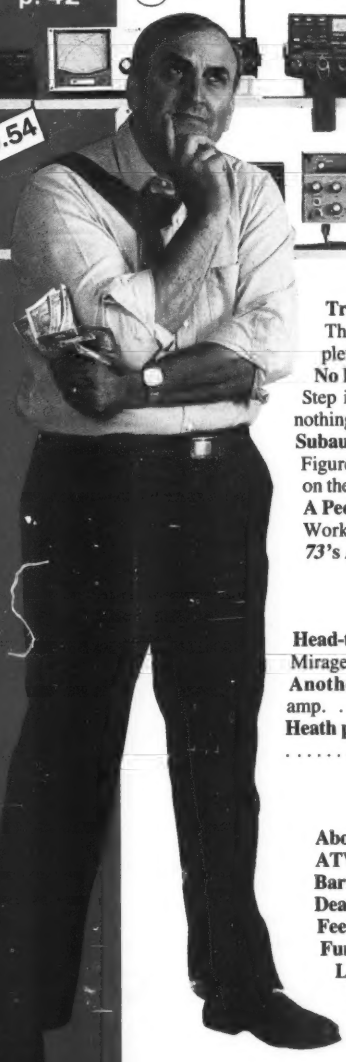
BUYING GUIDE p.54

Sure Cure For RFI p. 32

Easy C-64 RTTY p. 34

Circuits From Garbage! p. 30

Simple Transistor Biasing p. 40



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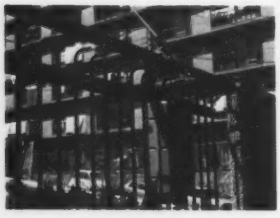
ICOM AH-2
MOBILE ANTENNA SYSTEM

ICOM presents the AH-2 automatic antenna tuning system for its HF transceivers. The AH-2 is ideal for mobile operators since there is no manual antenna tuning needed...an advantage in inclement weather. Also, the AH-2 system enables auto tuning in areas where antennas are limited, such as apartments and condominiums.



The ICOM AH-2 System combines advanced matching techniques and rugged construction for indoor or outdoor use to match frequencies from 3.5MHz to 30MHz. The system includes an antenna element, and the AH-2a tuner and controller units.

The AH-2a Controller Unit easily attaches to the side of ICOM's HF transceivers. By simply pushing the TUNE button on the front panel of the AH-2a controller unit, the controller automatically tunes from 10 to 80 meters in less than six seconds. It can also be used on the 160 meter band with an extension of the stainless steel whip.

The AH-2a Tuner Unit enables optimum matching conditions via its built-in 8-bit microcomputer and LC (coil/capacitor) circuit. More than 260,000 LC combinations are possible.

The AH-2 System is compatible with the IC-735 HF transceiver. Plus, when used with the optional OPC-137 it is compatible with the IC-701, IC-740, IC-745, IC-751, and IC-751A.

The AH-2a Tuning Unit is housed in a durable weather-resistant case and is capable of storing tuning information for eight different frequencies. Retreiving tuning data from the memories is quickly accomplished in less than one second!

The AH-2a can be purchased separately to accommodate the ham who already has a bumper mount and whip antenna, or the apartment/condo dweller who wants to match a random wire.

The Antenna Element includes sturdy bumper mounts which hold the 107 inch stainless steel whip in place, plus all the necessary hardware.

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First in [illegible]

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3150 Premier Drive, Suite 126, Irving, TX 75063
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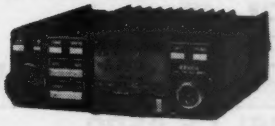

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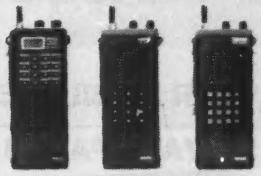

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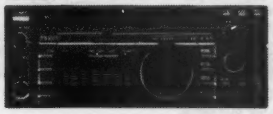
IC-04AT IC-4AT

ICOM IC-735



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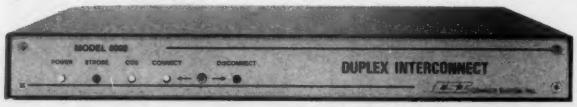
VISA

MODEL 8000 DUPLEX



- Desk top or rack mounted versions
- Pulse or fully regenerated tone dialing
- Full and half duplex operation
- Half duplex privacy mode
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- Secret toll override code
- ✱ up # down or multi-digit access
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- End to end signalling (DTMF standard)
- Auto answer on 1st, 2nd, 4th or 8th incoming ring
- Mobile to mobile signalling
- Telephone initiated control mode
- Dip switch selectable hybrid compensation capacitance.
- Programmable timout and mobile activity timers with unique beeps
- Disconnect beep
- Separate repeat level control
- Lightning protection
- Connectors for options
- 10-16VDC powered

28 dip switches make all features user programmable and selectable.

OPTIONS

8001 ANI code validator (up to 1024 access codes)
8002 1000 call two tone signalling
8003 32 call CTCSS signalling
8004 FCC registered coupler
8005 Centralized computer billing system

NOW ANYONE CAN ENJOY FULL DUPLEX!

Merely connect a CSI Model 8000 to any duplex base (such as the Yaesu FT-2700RH) and presto...you have an instant full duplex mobile telephone system!

Or, the 8000 can be connected to any repeater for shared use. A landline caller can selectively call any mobile on the system with (end to end) regenerated DTMF (standard), CTCSS (optional) or two tone sequential (optional). Mobiles can even selectively call **each other**!

Knowing the correct code, a caller can **take control** of the 8000 from any touch phone and **voice communicate** with mobiles that are not equipped with touch dialers.

No other duplex patch offers so much for so little.

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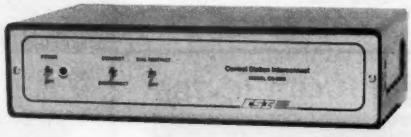
MODEL CS-9500



For exemplary simplex performance, the CS-9500 control station interconnect incorporates a full ½ second of landline to mobile electronic voice delay. Voice delay assures compatibility with the slowest CTCSS or trunked repeater systems.

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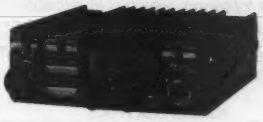
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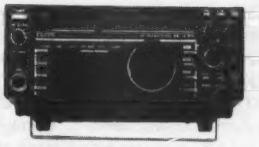
IC-3AT
IC-4AT

IC-751A

IC-3200A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TM-3530A

TS-440S

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NEVER SAY DIE

Number 20 on your Feedback card

The following, which is in extraordinarily bad taste, should not be read by Extra-class hams—or anyone planning to be an Extra.

KILLER EXTRAS

When the word got out that the Oklahoma mass murderer was an Extra-class ham, someone mentioned that the Atlanta mass murderer had also been an Extra. Hmmm.

Well, I don't think there's ever been any question about hams being crazy—it's just that we've never really figured out whether we become hams because we're crazy or amateur radio makes us crazy. Chicken or egg? We need some serious research, eh? I'll put my money on Morse code as the unbalancing factor. All those dits and dahs could easily flip one out.

Hey, don't get mad at me for breaking the bad news that you're crazy. Crazy is just like alcoholism, smoking, and other insanities—the absolute last one to recognize there's a problem is the crazy. Look, if you think I'm exaggerating just ask any non-ham friend whom you really trust and see if he or she doesn't agree with me that you're crazy.

How else can you explain someone sitting for a lifetime trying to collect QSLs from 325 countries? There's no way to explain that as sane. And how about those of us who talk ourselves hoarse for 33 hours on a weekend trying for a dumb contest certificate? Let's see you come up with a rational explanation for ham contests. Can you explain traffic handling with a straight face? And the loonies bouncing signals off the moon?

Hams get mad when I point out that the CBers who've been arrested and put in prison for using bad language over the air over long periods of time have all been Extra-class hams. How sure are you that it isn't the 20 words-per-minute code test which does it? How else can you explain all of the really outstandingly crazy hams being Extra class? Hey, I'm sure glad I didn't get my Extra! If I'd gotten it I'll bet I'd be out there getting even with some of the people who've done me in the most in life—instead of waiting until the next life to come back and haunt the hell out of them. I intend to come back with a vengeance—none of this wimpy forgive and forget, no sir.

And those who've gone out of their way to screw me and have had the bad grace to die—I'll get those bastards when I get there. Watch out Jim Fisk. Watch out Clay Pool. Watch out Budlong. And watch out you who have swiped my more treasured possessions. Watch out all you who have it coming—and you know who you are.

Hey, what with time being different in the next world, I may even be able to get started on readers who have let their *73* subscriptions lapse—ARRL directors who have bad-mouthed me in their talks—advertisers who haven't supported *73*. I'll be real busy, but it'll be fun.

A recent *W5YI Report* went on at length with interviews of good ham buddies of N5PS—all telling what a great chap he was. Some of you must know someone good at seances, so how about getting a QSO with Pat and see what he's got to say about the mess he made. Let's hear from N5PS direct and see what he's got to say about this Peeping Tom stuff in the magazines. Hey, I've peeped a couple

Continued on page 10

"Sorry to hear about your line noise! We're rerouting our power lines seven miles to the west!"

QRM

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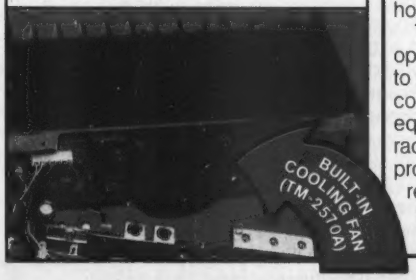
- TM-3530A covers 220-225 MHz
- Digital Channel Link (optional)

Large heatsink with built-in cooling fan (TM-2570A)



DCL **Introducing... Digital Channel Link**

Compatible with Kenwood's DCS (Digital Code Squelch), the DCL system enables your rig to **automatically** QSY to an open channel. Now you can automatically switch over to a simplex channel after repeater contact! Here's how it works:

The DCL system searches for an open channel, remembers it, returns to the original frequency and transmits control information to another DCL-equipped station that switches **both** radios to the open channel. Microprocessor control assures fast and reliable operation. The whole process happens in an instant!

Actual size front panel

Optional Accessories

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- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply for TM-2550A/2530A/3530A
- **PS-50** DC power supply for TM-2570A
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48B** extra DTMF mic. with UP/DWN switch
- **MC-43S** UP/DWN mic.
- **MC-55** (8-pin) mobile mic. with time-out timer
- **SP-40** compact mobile speaker
- **SP-50B** mobile speaker
- **SW-200A/SW-200B** SWR/power meters
- **SW-100A/SW-100B** compact SWR/power meters
- **SWT-1** 2m antenna turner

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The first is still the best! The original FM "Dual Bander." TW-4000A delivers 25 watts output on both VHF and UHF in a single compact package.

- **2 m and 70 cm FM in a compact package.**
  Covers the 2 m band (142.000-148.995 MHz), including certain MARS and CAP frequencies, plus the 70 cm FM band (440.000-449.995 MHz), all in a single compact package. Only 6-3/8 (161)W x 2-3/8 (60)H x 8-9/16 (217)D inches (mm), and 4.4 lbs. (2.0 kg.).
- **Single-function keys allow easy operation.**
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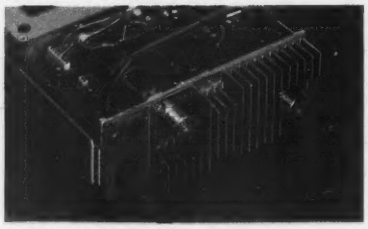
  A green, multi-function back-lighted LCD display for better visibility. Indicates frequency, memory channel, repeater offset, "S" or "RF" level, VFO A/B, scan, busy, and "ON AIR." Dimmer switch.
- **Front panel illumination.**
- **10 memories with offset recall and lithium battery backup.**
  Stores frequency, band, and repeater offset. Memory 0 stores receive and transmit frequencies independently for odd repeater offsets, or cross-band (2 m/70 cm) operation.



- **Rugged die-cast chassis.**
- **Two separate antenna ports.**
  Use of separate antennas is recommended. This simplifies antenna matching and minimizes loss. However, mobile installations may require a single antenna. The optional MA-4000 dual band mobile antenna comes with an external duplexer.
- **Programmable memory scan with channel lock-out.**
  Programmable to scan all memories, or only 2 m or 70 cm memories. Also may be programmed to skip channels.
- **Band scan in selected 1-MHz segments.**
  Scans within the chosen 1-MHz segment (i.e., 144.000-144.995 or 440.000-440.995, etc.). The scanning direction may be reversed by pressing either the "UP" or "DOWN" buttons on the microphone.
- **Priority watch function.**
  Unit switches to memory 1 for 1 second every 10 seconds, to monitor the activity on the priority channel.
- **Common channel scan.**
  Memories 8 and 9 are alternately scanned every 5 seconds. Either channel may be recalled instantly.
- **High performance receiver/transmitter.**
  GaAs FET RF amplifiers on both 2 m and 70 cm, high performance monolithic crystal filters in the 1st IF section, provide high receive sensitivity and excellent dynamic range. The high reliability RF power modules assure clean and dependable transmissions on either band.
- **Optional "voice synthesizer unit."**
  Installs inside the TW-4000A. Voice announces frequency, band, VFO A or B, repeater offset, and memory channel number.
- **Repeater reverse switch.**

More TW-4000A information is available from authorized Kenwood dealers.

Optional accessories:

- VS-1 voice synthesizer
- TU-4C two-frequency CTCSS tone encoder
- PS-430 DC power supply
- KPS-7A fixed station power supply
- MA-4000 dual band mobile antenna with duplexer
- SP-40 compact mobile speaker
- SP-50 mobile speaker
- MC-42 UP/DOWN microphone
- MC-55 8-pin mobile mic. with time-out timer
- SW-100B SWR/power meter
- SW-200B SWR/power meter
- SWT-1/SWT-2 2 m/70 cm antenna tuners
- PG-3A noise filter
- MB-4000 extra mounting bracket

Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.
Antenna mag mount is not Kenwood supplied.

KENWOOD

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Number 25 on your Feedback card

Antennas Away

THIS FROM OUR "Talk About A Nice Guy" department: **Ralph Jannini KA1FAA** of **Unadilla/Reyco** dropped us a note describing his company's new antenna give-away program. To encourage established ham radio clubs to sponsor radio clubs in schools, Unadilla will give *new* school clubs a Unadilla 40/80m antenna kit. To qualify, just have your school principal and the president of the sponsoring radio club drop a note to Ralph describing what's going on. There is a catch—the offer is limited to only five new clubs per state per year. You can get in touch with Ralph at Unadilla/Reyco/Inline, PO Box 215BV, Andover MA 01810-0814.

Big Pitch

WE THOUGHT that Unadilla's idea was so good that we came up with our own little pitch. We'd like to see ham radio magazines in every school library in the country (note: that's ham-radio magazines, not *Ham Radio* magazines!), so we've set up a way for you to sponsor a school subscription. For $15 a year—about 4¢ a day—you can be the one who gets the kids in your local school excited about amateur radio. At $15 we're not making any money, but amateur radio could be picking up another youngster. Well worth it, don't you think? To get this going, send us the name and address of the school library you'd like to sponsor. We'll get their subscription going and send them a letter pointing out your generosity. We'll also publish your name right here in QRX as our way of publicly thanking you for your support of your hobby. Send your info to *73* Magazine, Editorial Offices, WGE Center, Peterborough NH 03458.

Camp Kids

OK, WE'RE ON A ROLL with this kid stuff, so let me tell you about a group of hams who got together up at the YMCA's Camp Manito-wish in Wisconsin. Their ninety-minute presentation covered the highlights of our hobby, starting with a quick overview of ham radio history by **Don Kupferschmidt KD9PT**. Don also touched on our new volunteer licensing program and the differences between CB and ham radio. **Jay Van Der Burgt KA9MSR** jumped in next to help demonstrate various modes of operation, with CW demonstrated by **Mike Kurtz AA9Y** and SSB shown by **Jack Peterson KC9NE**. KJ4R and KA9ODM helped out by operating from their homes a few miles away (an exceptionally good idea . . . nothing's worse than standing in front of 100 fidgeting kids calling endless CQs, praying for someone, *anyone* to please, please come back to you!). More quick demos followed with Don describing VHF and repeaters, and packet radio. Finally, a question-and-answer period wrung out the adults with those difficult queries that come only from eager young minds. The point of all this is that taking ham radio to the kids is a heck of a lot of fun, isn't hard to do, and plants that little seed in their minds that, "Hey, isn't this neat? I could do that!" Be sure to send your stories to QRX so everyone can get ideas on how to do this sort of thing.

Calling Canada

WE HAVEN'T HEARD MUCH from our neighbors to the north recently, but rumor has it that the Department of Communications (DOC) is letting hams up there pick their own callsigns. (You have to wonder when things up there get quiet—Garrison Keillor of *A Prairie Home Companion* claims that the Canadians are plotting to invade the U.S. "You just can't trust them," he says. "They're too quiet.") **Bill Leal VE3ACY**, president of the Windsor Amateur Radio Club, mentions in *Ground Waves* that the DOC has everything all set up on a computer, and you tell them what call you want and they just give it to you. He changed from VE3IHB (I can see why!). On our side of the line, it looks as if the FCC will be letting us do about the same thing in the very near future. The FCC will still issue the "official" callsign, but you'll be able to buy any call that you like and use that one on the air. The Feds will have a cross-index of who has what, so they can still nail you with a pink slip if you screw up. Things are in the rough planning stage as this is being written, but when it all firms up we'll have all the details. (I certainly wouldn't mind getting rid of KW1O. Yechh. Wayne says he would pay big money for the call he wants: "W.")

Book Nook

HERE'S YOUR CHANCE to pick up Christmas gifts for everyone you can think of! *73* is back in books; we're kicking things off with two classics: ***The Contest Cookbook*** by Bill Zachary N6OP and ***The Magic of Ham Radio*** by Jerrold Swank W8HXR. The *Cookbook* covers every aspect of amateur contesting, from station layout to equipment to techniques. Separate chapters are devoted to domestic, DX, and VHF contests. This book includes tips from winners on how *you* can be a contender! 170 pages, $5.95. Jerrold Swank's *Magic of Ham Radio* is filled with the excitement of amateur radio—stories of daring rescues and life-saving communication. This is a book you'll want to give to your friends when you want them to become interested in ham radio! 156 pages, $4.95. Send your order to *73* Books, WGE Center, Peterborough NH 03458. Please add $1 to your order for postage.

Hamming it up at Camp Manito-wish. Photo by KC9NE.

Chip Tip

CHUCK HOUGHTON WB6IGP say that some folks are having trouble getting the TDA-7000 chip for his i-f amplifier ("Microwave Building Blocks: The I-f Amplifier," October, 1986, page 42). Chucks says that he has picked up a gross and will sell both the TDA-7000 and the printed-circuit board for the project for $10 postpaid. Get in touch with him at 6345 Badger Lake Road, San Diego CA 92119.

MARC Mark

THE MICHIGAN AREA REPEATER COUNCIL has overwhelmingly voted to move directly to a 20-kHz band plan in the state. Existing repeaters have all been included in the new coordination scheme, although a few sites have some problems. MARC officials expect to have everything resolved and all repeaters in Michigan on the 20-kHz plan by year's end. The council also has elected new officers: **Rod Moag W8NDS** takes over as Chairman, **Jim Brooker NI8E** steps in as Vice-Chairman, and **Paul Englehart KA8BFF** keeps his post as Secretary.

ATIS Onus

THE FCC is looking at a proposal (GR Docket 86-337) that would require an automatic identification of all satellite uplink signals. The system, cleverly called the **Automatic Transmitter Identification System (ATIS)**, would help track down interference in the satellite service, whether it is deliberate or accidental. A unique identification code would be imbedded in every transmitter at the time it was manufactured. Vigilantes like Florida ham Captain Midnight are fairly rare, but it is common for technicians to aim portable uplink dishes at the wrong satellite. ATIS would allow for instant identification of the culprit. Of course, a true hacker out to ax a bird would not worry at all about ATIS . . . he would find some way

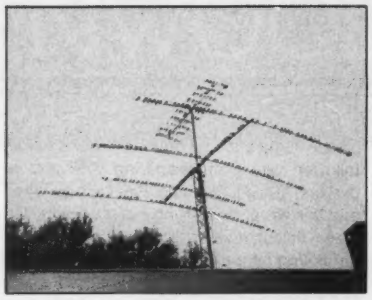
around it. What interests hams about 86-337 is that the FCC is also asking whether *all* radio transmitters should be equipped with ATIS; that includes ham gear. Hmm. . . maybe we could do away with callsigns altogether.

Still III

THINGS LOOK GRIM for our old friend AMSAT-OSCAR 10. Efforts to write a program that could work around damaged areas in memory appeared at first to be successful, but in the past few weeks more problems have surfaced that spell the end of AO-10. The satellite is operating right now in an unpredictable manner; you never know what mode is going to be on when. The mode-B transponder is stuck on, and AMSAT ground controllers have been allowing limited mode-B operation during part of each orbit. AO-10 will be moving into an eclipse period very soon, and unless something drastic happens to perk the bird up, it will not receive solar energy to charge the batteries. There is currently no way to adjust the satellite's sun angle to compensate for the diminished sunlight—once the batteries are dead, AO-10 will be silent.

Contest Code

FREE SOFTWARE is available from **Bill McClellan KVØI** for Commodore C-64 or C-128 owners who plan to operate in the 1987 *73* World SSB Championships. The program is a logger for the contest, and features a fast machine-language duper/sorter, real-time scorekeeping, and hard copy of logs. (We'll be printing the rules for the Championships next month, along with the results of this year's test.) If you would like a copy of the program, send a self-addressed, stamped disk mailer (SASDM?) to Bill at 3304 Jo Ann Avenue, Omaha NE 68123.



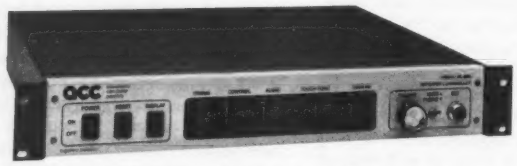
"Seems this fellow was hearing a few birdies in his receiver. . . ." Photo by WØRIM.

Fuji OK

AMATEUR RADIO'S newest satellite was launched after a few delays on August 12th. The bird has worn three names, starting life as JAS-1, changing to OSCAR 12 after launch, and now rededicated **Fuji-OSCAR 12 (FO-12)**. Japanese spacecraft are christened with a flower's name when they start operation in space; Fuji is the Japanese word for wisteria. Early users report that FO-12 is very sensitive, easily accessed with only 100 Watts erp. Mode-JA uplink is from 145.900 to 146.000 MHz, with the downlink falling at 435.900 to 435.800 MHz. The transponder inverts uplink signals: To calculate a downlink frequency, subtract the uplink frequency from 581.800. The beacon is at 435.797. JARL recommends that CW be used in the lower third of the passband (435.800–435.835 MHz), with SSB in the upper third (435.865–435.900 MHz) and mixed CW/SSB in the middle third. The digital transponder, mode JTD, is currently being tested and should be running by the time you read this. For tracking information, get in touch with AMSAT at PO Box 27, Washington DC 20044.

Done

That's a wrap for this issue. We had input from *The W5YI Report, Amateur Satellite Report, The Westlink Report,* and John Hackman WB4VVA. We're always looking for fun stuff to run; send your news to *73* Magazine, WGE Center, Peterborough NH 03458, Attention QRX. Slip a twenty in the envelope if you *really* want your item published (just kidding, Wayne. . .). Oh, you can also send things via CompuServe at 70310,775, or via MCI Mail at WGEPUB.



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Individual user access codes, with callsign readback, give you *secure* access to selected functions to completely prevent horseplay.

Advanced Computer Controls continues to lead the way in advanced repeater technology, changing the face of amateur repeaters every day. ACC controllers offer users, control operators, and site managers features and tools to make operation more convenient, useful, and FUN!

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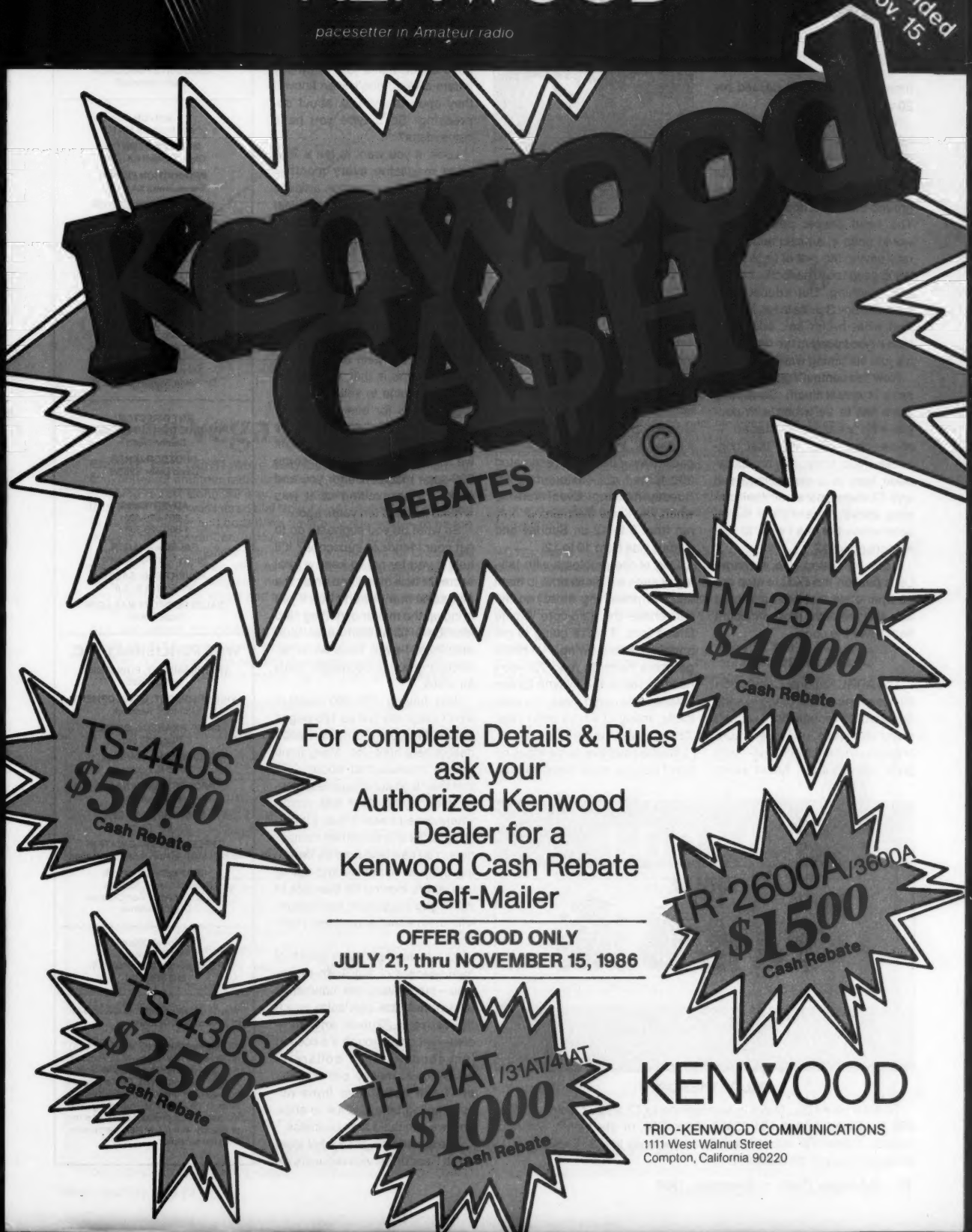

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NEVER SAY DIE

from page 4

times—I just haven't passed my 20-wpm test.

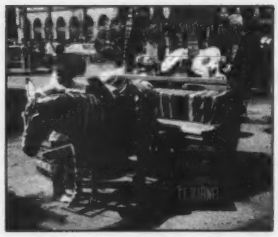
Yep, I peeped. Well, I have to tell you it was fun. That was back when I was 12 and in the Boy Scouts. After patrol meetings our group would go out and peep in ground floor apartment windows. The head peeper patrol leader would gasp in amazement, naturally driving the rest of us to peek. We'd gasp too. The fact is I never saw anything. But education is what the Boy Scouts is for, isn't it? And what better sex education than a good peep at the right time. It's just our timing was bad.

Now this camouflaged suit business is a real tipoff. Something extra has to be wrong with people who wear camouflaged T-shirts—sox—hats, and that nonsense. You show me an Extra-class ham in a camouflage suit and I'll show you some real running speed. Where's my bullet-proof vest—the one I wear to ARRL conventions?

I say let's stop this carnage. Let's petition the FCC to stop the 20-wpm code test before it's too late and we drive more innocent hams over the edge.

SAN DIEGO

The ARRL National Convention this year was in San Diego in early September. Though there weren't many exhibitors, the event sure brought out the local hams—very good attendance. I heard some estimates of 5,000. This is surprising for California. The weather couldn't have been better.



To celebrate W2NSD's visit to Tijuana during the ARRL National Convention, every donkey in the city was painted to look like a zebra.

Since I got on the speaker's list late, all they had left open was Sunday morning—sure death for a speaker. Well, the room wasn't packed as usual, but an estimated 300 turned out—astounding for Sunday morning. Even more so when you know the hamfest only ran from 9 to 12 on Sunday and my talk was from 10 to 12!

One of the problems with talking at such a difficult time is that I find I'm preaching mostly to the converted—the hard-core Wayne Green fans. If we're going to get amateur radio growing, I've got to get more hams to read *73*—so I need to reach the Wayne Green haters—and, even more, the apathetic, many of whom don't read *73* and haven't even heard of me.

Maybe you have some ideas on how I can get more hams to read *73*. Unless a lot of readers are lying to me, I've perked up the magazine so it's fun to read again—more fun than any other ham magazine—which, alas, isn't very difficult. When I send letters to the *Callbook* list I find that about 98% of the hams just throw my letters away. I don't even know if they open them. Talk about depressing! So maybe you have some ideas?

Look, if you want to get a 300-page magazine every month—packed with construction articles, hot news on packet, international news, and so on, it's going to take 120 pages of advertising. That's a fact of publishing life. And that doesn't put me on easy street, that's just in order to break even.

Now, how do we get 120 pages of ads the way we used to a few years ago? First we have to have about 120,000 paid readers. The rule of thumb is that a magazine should be able to sell about one page of ads for every thousand readers. So if we can double the number of *73* subscribers, I think we'll be able to turn out some 300-page magazines for you and make *73* as exciting as it was around five and ten years ago.

So what do you suggest I do to get your friends to subscribe? It'll help if you try not to keep a total secret of how much you enjoy the magazine now. It won't hurt if you bring up the matter of getting club members to subscribe at club meetings. I even have some attractive group subscription deals for clubs.

Just having 120,000 readers won't magically get us 120 pages of ads. I'm going to need a good deal of help here, too. Many firms are so brainwashed about *QST* that they'll go out of business never even trying their ads somewhere else to see if they'll bring more sales and save their companies. You can help here by bearding them at hamfests and telling 'em you're looking for their ads in *73*. If you happen to correspond with them about something, mention it.

73 has the most lively bunch of ham readers of any ham magazine—our advertisers constantly tell us their ads pull sales much better from *73* than anywhere else—yet even though it's costing 'em thousands of dollars in sales—cash money out of pocket—I see many ham firms not even giving us a chance to show how we can build their business.

The advertisers put a lot of store in the Reader Service requests we

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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We're Building the West's Largest Convention of Amateur Radio Operators

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EXCUSE OUR DUST! We're busy building the largest annual convention of amateur radio operators in the West and we're not stopping to rest along the way. Last year we called it "OCTOBER-VENTION" and it was incredible! Now it's HAM/WEST and it's going to be even bigger and better! We have only one goal — to be the biggest ham convention in the West! We've got it all — prizes, technical talks, exhibitors with those new products for Christmas, giant flea market, free VEC exams, free cocktail party, awards banquet and ladies' programs, not to mention all the fun, excitement and glamour of Las Vegas and the beautiful Western scenery and climate!

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November 7–8

All day Friday and Saturday

GENERAL INFO: Plan to travel on Thursday. Exhibits and forums will be open 8 a.m.-5 p.m. Friday and 8 a.m.-4 p.m. Saturday. Awards banquet will be at 8 p.m. Saturday.

REGISTRATION INFO: Every person taking part in the HAM/WEST activities must be registered. Advance registration is $12 before October 24 ($15 at the door) and includes prize tickets and admission to all HAM/WEST activities except the banquet. It is not necessary to be registered to purchase tickets for the Saturday evening awards banquet. Flea-market sellers must be registered; outdoor spaces measure 16'x20' (two parking spaces). Born in 1966 or later? Request complimentary "admission-only" tickets (no prizes) at the door. And — there's no fee for VEC exams taken at the convention!

HOTEL INFO: To guarantee your room, you must **make your room reservations directly with HAM/WEST**, either on this form or by phone (if charging to a credit card), and **make payment in full before October 1, 1986.** Reservations not paid by that time will be accommodated on a *space-available basis only.* Call HAM/WEST at 702-361-3331.

RV INFO: Call Camperland directly at 800-634-6942 to reserve a space with full hookups right on the hotel grounds. Be sure to mention HAM/WEST. Call now. These spaces fill up early!

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(Please enclose a self-addressed, stamped envelope marked "VEC Exam" with this application if you are planning to take an exam.)

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Register room to _____
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How many persons will stay in this room? ( ) One ($55.00/night) ( ) Two ($55.00/night) ( ) Three ($65.00/night) ( ) Four ($75.00/night)

How many beds do you need? ( ) One double bed ( ) Two double beds ( ) One king-size bed

Any special requests? _____

Amount for room	$_____	( ) **Check or money order enclosed**
Plus 7% room tax	$_____	( ) **Charge to credit card #** _____ Exp. date _____
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Banquet, $20/person	$_____	( ) M/C ( ) VISA
Flea market, $20/space	$_____	( ) AMEX Authorized Signature _____
Total amount	$_____	Note: We will bill your credit card account in full when your registration form is received.

HAM/WEST, P.O. Box 19675, Las Vegas, NV 89132, 702-361-3331

pass along to them, so make sure you send for information on any product in which you're interested. They also have to make sales in order to stay in business, so don't jerk them around.

If you get to any of the major hamfests, you know that the bulk of the firms selling products to hams are small and run by hams. Indeed, no one else would bother to try to survive in such a dying market. In the past, a large part of the sales of ham gear was to newcomers. These days, with newcomers dropping more and more every year, much of those sales are gone. That leaves us with a relatively small group of active hams—plus a raft of semi-active—the hams who have been rag-chewing for years with the same old gear—talking with the same people year after year.

DXers and contesters have to keep more up to date or else they fall behind. We're seeing most of the top DXers and contest hams using the newest computer-controlled rigs—putting up newer and better antennas every couple years—using a computer for log and record keeping.

The chap in the booth next to *73* had a corking good program for working the Sweepstakes contest—a contest I always used to enjoy. It keeps track of every contact, checks for duplicates, let's you know what sections have been worked and which are still needed, and so on. It sure would have made my contesting a lot easier to have an aid like that at hand!

W2NSD/ZF groping for grouper in Cayman Brac.

Speaking of contests, it's getting on time for someone with contest experience to write some instructions on how to win contests. Contests are won, for the most part, by hams who thoroughly believe that winning isn't just important—winning is everything. So I'd like to see helpful hints on winning contests—like how to leave openings in your log for the later insertion of normal-looking mythical stations from missing sections or countries. After all, the contest log checkers can't verify everything, right? So if you put in some calls you know, but which you didn't hear during the contest, who's to know? It's despicable to win a contest certificate by such scurrilous skulduggery, but unless we let everyone know the contemptible techniques used by some of the high scorers who seem to have forgotten that amateur radio is a hobby—for fun—they'll be at a serious disadvantage. Only by bringing such treachery out in the open can it be thwarted, so let's have some facts on how some conscienceless hams have been screwing their more honest fellow hams.

One of the more fun aspects of the hamfest was the hospitality suites after the show closed. The 10-GHz group outdid everyone else with a bluegrass band—Gerry Earl N6LYX lead guitar and singer. Of course I'm a sucker for bluegrass music anyway. I've been increasingly upset that no bluegrass has yet come out on CD (at least that I know about). I wonder how many ham bluegrass groups there are out there? I'd sure like to find one in each city where there's a major hamfest so I could organize a hospitality room, complete with a small band.

My good friend Chuck Martin WA1KPS, who used to run Tuft's Electronics, plays a mean blue-

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grass guitar. It made the drive from Denver to Aspen go quickly as we sang our way across the mountains on our yearly ham industry skiing trip there. I think we'll be hitting Aspen again this January—HTs tying us together as we ski the different areas.

I wish a group in San Diego would get a yearly hamfest started so it could build up attendance. You don't get a big pull the first year or two—these things have to build up.

San Diego isn't far from L.A.—has perfect weather—it could do well as a yearly hamfest site. It's got plenty of interesting things to see—such as Old Town, Tiajuana, and the famous San Diego Zoo. Let's do it again.

The Las Vegas hamfest in November looks as if it will be a yearly affair, so I'm rooting for it. The chap running it has lots of good ideas and needs all the cooperation he can get. The old Saroc hamfest built up for a while, but then was killed off by what I saw as extraordinarily poor management. I know I got lied to and shafted—and I heard from others with similar problems.

By having the hamfest just before Comdex, it should pull in not only those California hams who enjoy a couple of days in Vegas, but get the computer industry hams to come a couple days early—and there are a whole lot of hams in the computer business.

THROW YOURSELF INTO THE VOLCANO

It's getting time for some human sacrifices if we're going to save amateur radio. It's a drought and the crops are dying. How about you—are you willing to sacrifice to help stop the bleeding?

A letter from Ed WB6IDP had a good suggestion. One of the reasons we're losing more and more hams every year is that such a high percentage of Novices aren't making it to Tech or General. If we could improve the percentage of Novices who stay with us, we might at least break even and stop falling behind.

If we can get Novices to increase their interest in amateur radio, we stand a very good chance they'll infect some of their friends with their enthusiasm and help us get more Novices. This goes particularly for the 15% of the newcomers who are teenagers—the ones we need most to reach.

Okay, how can we get Novices to stick around? Well, one simple way is to make sure they find amateur radio fun. Novel thought, eh? Now let's have a show of hands—how many of you have worked a Novice in the last two months? Humph, I thought so. You're so damned busy rag-chewing you haven't any time to try and make life more fun for Novices. What the devil do I have to do, start a contest and give certificates to bribe you to do your civic duty and put in some time with your key and help our Novices have some fun?

Let's be honest about this now. . . you're probably going to have to do some code practice to get your speed up to five per so the Novices won't embarrass you. If I had it my way every ham who insists on our keeping the code test would have to be tested every year at a minimum of 35 wpm. So get out your code tapes and spend a few weeks getting your speed up to 5 wpm and then get on one of the Novice bands and be nice. None of this QLF crap, okay? I can't tell a D from a TI when you send it, you know. Bad when you have the DTs. Let me know how long it takes you to figure that one out.

Rather than tell the poor Novice about that old rig you're using, I suggest you look up one of the modern ones in *73* and just tell 'em you're using one of those. After all, the chances are your rig was made before the Novice was born and he's never heard of it. Once the ARRL gets their new $6 million museum up and running, Novices may get to be more familiar with your gear.

I'll bet you thought I was going to be critical of the League for putting so much into a museum instead of investing it in promoting the growth of the hobby. Nope, not me. I think they see amateur radio about to crash in the near future, so the best possible investment will be a museum so later generations will be able to know there once was something called amateur radio. Good move. I've got some first-class stuff I might donate. . . been wondering what to do with it.

I can hear the consternation now as Extra-class ops ask each other where the Novice bands are. Anyone got a *Callbook*? Maybe there's a frequency chart in there. How about the *Handbook*? Hmmm, I wonder if my 1955 edition is still okay to use? I don't see any point in buying the damned things every year.

Continued on page 62

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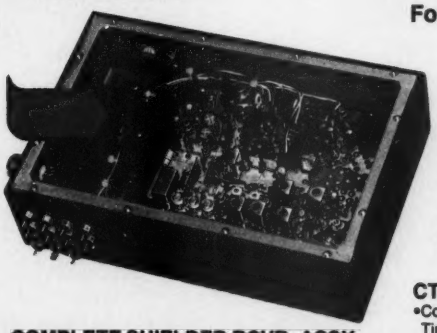

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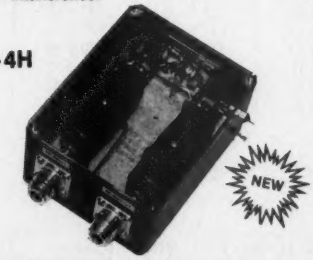

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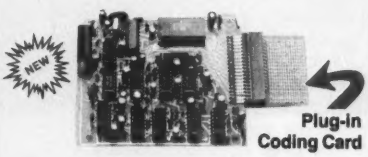

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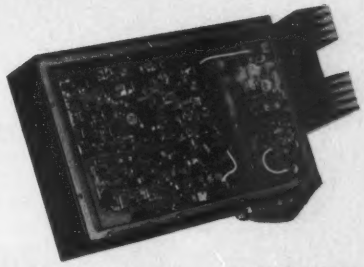

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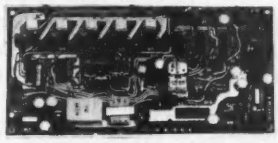

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82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
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What's Gray and Green and heard all over?

(Answer on page 89)

What's Gray and Green

and heard all over?

(Answer on page 89)

LETTERS

Number 18 on your Feedback card

THE FIRST

J. L. Reinhartz did not originate the feedback circuit shown on page 68 of your September issue ("Kit Corner: Build a Two-Tube Receiver"). The first article covering the use of a fixed "tickler" for feedback and a variable capacitor for ease of control was the lead article in the December, 1919, *QST*. The author was "Donald F. Alexander, radio 1BK." I had just received license 1BK on October 1, 1919, but had been building receivers for two years.

The editorial box at the top of the article said, "This article is a description of a tickler-feedback set, and is destined, we believe, to be popular.... Receivers containing variometers are difficult of construction in the home workshop. Mr. Alexander's set is a cinch...."

My mother once told me of my father, "Son, your father has now an incurable disease...it is called the plague of total recall." So forgive me, too.

Don F. Alexander W8LK
Dayton OH

Forgiven. And, unfortunately, forgotten.—KW1O.

OUT OF TOUCH

In response to the August, 1986, Letter "AM-ATEUR RADIO":

Writers submit AM articles only to publishers interested in publishing AM articles; therefore you never see any at *73*. If you never read any then it must be by choice because there are plenty out there.

Ever wonder why new transceivers have an AM mode? Is it because manufacturers are out of touch, or could it be that publishers are out of touch?

W6RNC is not stuck in the hobby of 40 years ago as you stated. He is 10–20 years ahead of his time. And don't feel sorry for W6RNC, feel sorry for yourself because you're the one missing out.

One final note. Get your equipment this year. The cost of the old gear is going up, up, up.... No one is making it any more, and once it's gone it's gone forever.

Art Rideout WA6IPD
Fallbrook CA

There seems to be a problem here. We don't publish AM articles because we don't get any; you don't send any in because we don't publish them. Believe me, 73 will survive a lot longer without AM articles than AM will without articles in 73. So the burden is on you and the AM community to come up with some interesting projects to send in—and I promise you that 73 will publish any article we think is worth reading...even if it's about AM.—KW1O.

FUNNY PAPERS

For years now I've been trying to promote ham radio to the younger generation; I just keep failing. Let's face it, the Japanese influx of computer games, cheap computers, and chicken band gear is hard to compete with. I sometimes think that the Japanese obsession with monster movies some years back was prophetic...they're likely to become the monster that ate the world.

Kids are highly impatient—they want it now. Kids aren't going to plunk down $300 for some used gear if they don't have any interest. To generate this interest, they need the rig. Catch 22.

Young minds are innovative. If you can spark their interest, they soon find ways to get the money for bigger and better things. Home-brewing tends to foster basic skills and insights that appliance operators never will develop. I have known graduate engineers in our electronics industry who didn't know how to solder. This is how the Japanese got the ball from us and are running with it. Newington's answer to all this is a comic book. It is comic in more ways than one. The best it can hope to do is generate more appliance operators.

George Hermann N9BNH
Chicago IL

George, I agree with you that home-brewing is a great way to develop electronic savvy. However, we're looking at a hobby that's changing...and holding on to the "old ways" just won't cut it anymore. There's nothing wrong with being an appliance operator; after all, the goal of ham radio is to communicate, not to sit around building transceivers. Giving Novices voice privileges is a good first step. Now let's push to drop the code requirement from the Novice license and really *start communicating!—KW1O.*

DOWNHILL

I believe that a high priority in the program to get amateur radio growing should be to prevail on the FCC to not discriminate against our young people, presently licensed as Novices or planning to become hams, in not allowing A3E in the proposed new "enhanced" Novice 10-meter phone band. I would like to remind the people at the ARRL who proposed this that this hobby of ours would not have grown as it did without a mass migration of us old-timers to 160-meter phone (AM) operation in the early 30s.

The reason the hobby is going downhill today is that our ham magazines no longer publish articles on how to build your own simple gear for a first station setup. The big bucks cost of the rigs presently advertised is out of reach for the majority of young people who might consider sweating out the Novice license requirements. With availability of the information and parts to build one's own gear, these people would be interested in becoming hams. The problem here is to turn around the present situation so local parts suppliers can get back into business to supply this group of prospective hams.

Irving Megeff KD2EF
Flushing NY

The cost of ham equipment is about the same as that of a stereo, or a home computer, or a dirt bike. Price is not the problem. Showing kids how to build a station out of a scrap TV won't help, either—at best they'll get a QRP transmitter that barely gets out of the yard and a junky super-het receiver to match. Big deal. What we need is to get kids talking to each other, and that means starting up clubs in every school in the country. That's *our high-priority program.—KW1O.*

OLD FRIENDS

Wayne: Here's a note to bring back some memories of your visit to Aqaba, Jordan.

Our family met your family during one of your many trips overseas. It was my pleasure that you used my rig to make some QSOs from our QTH. I really wished you could have stayed longer, as there were a million questions I thought of asking...after you and your wife had gone.

Anyway, I'm back in the U.S. now, operating as N4JFS instead of the pileup-grabbing JY9CW, and I'm beginning to feel like a small pea in a very large pot—it's terrible being a has-been. How about an uplift, Wayne? It would do me wonders.

Matt Barbani N4JFS/JY9CW
Vienna VA

Of course I remember my visit to Aqaba and getting on the air from your station. And sure, I'll see if I can't get your picture in 73. That should give you some attention on the air. I had a great time at Aqaba—particularly the birthday party you took us to—and the scuba diving in the Gulf of Aqaba with HM's equipment.—Wayne.

Matt Barbani N4JFS/JY9CW.

NEW PRODUCTS

Number 21 on your Feedback card

DIAMOND SYSTEMS HAM TESTS

Diamond Systems has introduced a computerized self-testing study guide for IBM and Apple computers. Separate tests are available for each class of license. The program provides automatic random selection of questions from the appropriate question pool and keeps a running count of the total number of questions answered, the number of wrong answers, and the percentage of correct answers.

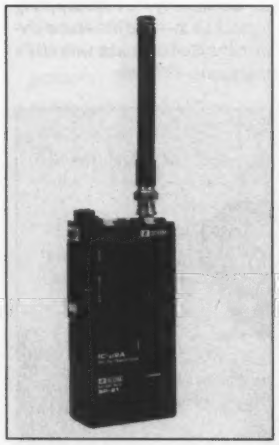
The Novice test is $24.95; all other tests are $34.95. For more information, please check Reader Service number 206.

TWO NEW ICOM HTs

ICOM has released the 220-MHz counterpart to the popular IC-02AT and IC-04AT hand-helds. The IC-03AT features coverage from 220–224.995 MHz, an LCD display, a DTMF pad, 2.5 Watts rf out, 10 memories, memory scanning, programmable scanning, and 32 built-in subaudible tones. The HT comes with an IC-BP3 rechargeable battery pack, an ac wall charger, a belt clip, and a wrist strap.

The second entry is ICOM's IC-μ2AT pocket-sized 2-meter handheld. The Micro covers 139–174 on receive, and transmits from 140–150 MHz with 1 Watt output (1.5 Watts with an optional battery pack). Other features include ten memories for storing frequency, offset, and access tone information; an LCD display on the top panel; scanning; and 32 built-in subaudible tones.

For more information, please check Reader Service number 213.



ICOM's new pocket-sized IC-μ2AT.

JENSEN TOOL KIT

Jensen Tools has introduced a new kit featuring tools for troubleshooting, servicing, and repairing all types of electrical and electronic equipment. Designated the JTK-84, the kit includes screwdrivers, nutdrivers, hex and spline drivers, pliers, cutters, wrenches, a hammer and punches, soldering equipment, and more. The kit is available in a vinyl zipper case or in a vinyl roll-up pouch that fits in a tool case or desk drawer.

For more details on this and other Jensen products, check Reader Service number 210.

Jensen's JTK-84 tool kit.

KENWOOD R-5000

Kenwood has released information on its new R-5000 HF/VHF general-coverage receiver. The R-5000 looks similar to the TS-440S and features full coverage from 100 kHz to 30 MHz; additional coverage from 108–174 MHz can be had with the optional VC-20 converter. The receiver's 100 memory channels store frequency, mode, and antenna selection information. Other features include Kenwood's DynaMix™ system for a 102-dB dynamic range, dual digital vfo's, direct keyboard frequency entry, a built-in power supply, and dual 24-hour clocks with timers. Accessories include a voice synthesizer, a computer interface, and a variety of filters.

For complete specifications, check Reader Service number 207.

TORONTEL SSTV SYSTEM

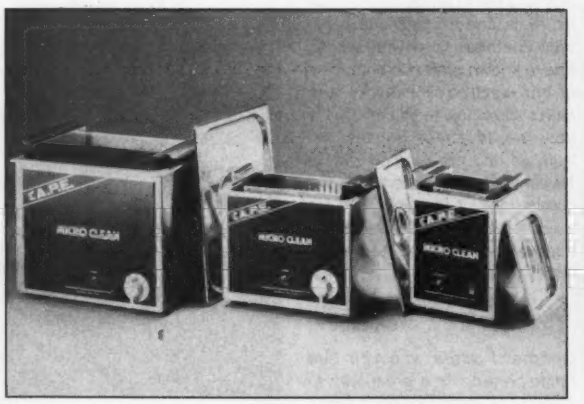
Torontel Technology Systems Graphics Environment for Slow-Scan Television (GEST) is an icon-oriented software package designed to marry the power of an IBM PC to Robot's 1200C color scan converter. GEST gives the SSTV operator a palette of over 250,000 colors (65,000 colors can be on the screen at any time), animation, image manipulation, image editing with over 20 functions, software signal processing and filtering, and a full 1200C control panel on the computer screen.

For complete information, check Reader Service number 208.

APE MICRO-CLEAN

Automated Production Equipment has announced a complete line of ultrasonic cleaners for the electronics industry. The A.P.E. Micro-Clean is available in sizes from 2 to 11 quarts, with prices running from $249 to $525. The cleaners are also available with custom-fitted covers, baskets, and trays.

For more information, please check Reader Service number 211.



A.P.E. ultrasonic cleaners.

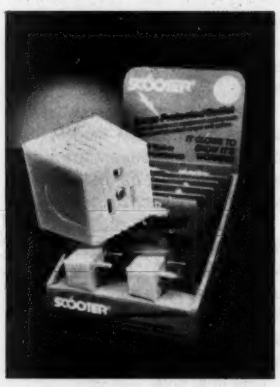
KAUL-TRONICS MESH ANTENNA

A new mesh satellite antenna, ideal for use on patios or other restricted areas, has been introduced by Kaul-Tronics. The Trans-7 is compatible with both C-band and Ku-band systems. Adaptable to either a patio mount or a polar mount, the black mesh antenna has an f/D ratio of .39 and a focal length of 33 inches. Gain is 37 dB on C-band and 43 dB on Ku-band.

For additional information on Kaul-Tronics antennas, check Reader Service number 212.

SCOOTER SURGE PROTECTOR

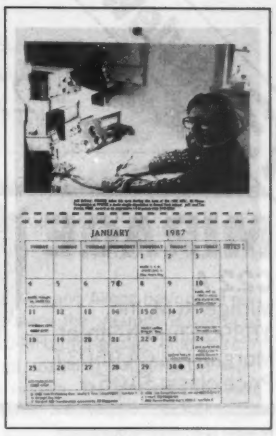
Ohm/Electronics has introduced its new Scooter™ model SP-100 Guard-It single-outlet



Single-outlet surge protection from Ohm/Electronics.

The Girard Protoflex-III printed-circuit system.

Free tool catalog from Jensen.



KB1T's ham radio contest calendar.

surge protector. This 125-volt, 15-Amp line-protection device plugs into any three-prong wall socket and glows to show that it's protecting your equipment against voltage surges. Use it to protect microcomputers, monitors, VCRs, radio gear, stereos, and so on.

Suggested retail price is $9.95. For more information, please check Reader Service number 214.

GIRARD PROTOFLEX-III

Girard Electronics now offers a new system for fabricating printed-circuit boards directly from CAD equipment without chemicals. The Protoflex-III model PF-IIIA works from a CAD schematic or line art (film positives or negatives, or patterns from a magazine) and can produce tin-plated copper patterns on a polyimide base at the rate of 75 square inches per hour. The flexible circuit can be laminated onto a double-sided board.

For complete information about the PF-IIIA, please check Reader Service number 209.

DAVLE TECH TOOL CASES

Davle Tech's models TC-11 and TC-15 are rugged, lightweight, vinyl-laminated aluminum tool cases featuring removable tool pallets, aluminum partitions in the bottom, soft handles internally reinforced with steel cable, and a one-year warranty. The TC-11 measures 18″ x 12.75″ x 5.5″, while the TC-15 is 18″ x 12.75″ x 8″. Both models are available with formed polyurethane foam, elastic pallets, or conventional pocket-type pallets.

For more information on these and other Davle-Tech products, check Reader Service number 215.

FREE TOOL CATALOG

A free catalog of tools and test equipment is available from Jensen Tools, Inc. Illustrated in full color, the 160-page catalog contains more than 1,000 items of interest to electronic service technicians, students, and electronics hobbyists.

Two new sections feature supplies and equipment for fiber optics and wire/cable systems. An expanded line of circuit board equipment includes breadboard kits, cutting tools, drill sets, insertion/extraction tools, and test cables.

For your copy of this free catalog, check Reader Service number 217.

KB1T PHOTO CALENDAR

KB1T Radio Specialties has announced availability of the 1987 Amateur Radio Photo Calendar. The 1987 edition is a 32-page spiral-bound book with two pages for each month: A 7″ x 10″ black-and-white photo of contest action on one page and dates and times for most of the major ham contests on the other. There's also plenty of room for jotting notes and keeping track of schedules.

The calendar is $11.95 plus $1 for shipping in the U.S.; for more information, check Reader Service number 204.

XCELITE CUTTERS

Static-dissipating sleeves, designed to control electrostatic discharges that could damage sensitive electronic components, have been added to the Xcelite® line of stainless-steel diagonal cutting pliers. Made of Benstat®, the sleeves do not contain carbon elements or other agents that particulate or slough. This makes the cutters ideal for clean-room applications.

The sleeves are available on six models of diagonal cutters (112CGSD–117CGSD); all six meet DoD standard 1686 and DoD Handbook 262 requirements for static-dissipating material.

For more details, please check Reader Service number 216.

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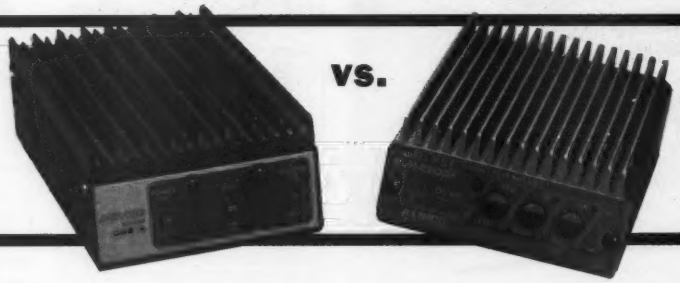
73 Review

Head to Head

220-MHz Rf Power Amplifiers

by Peter H. Putman KT2B

MIRAGE
C22 A
Mirage/KLM, Inc.
16890 Church Street
Morgan Hill CA 95037
Price class: $105



vs.

ALINCO
ELH-220GF
Alinco Electronics, Inc.
Box 2009
Reno NV 89515
Price class: $100

Number 11 on your Feedback card

There's no doubt that what makes the 220-MHz band "tick" is the large number of FM operators, especially in metropolitan areas. 220 has become a haven from the congestion and chaos of the 2-meter band in these areas. Surprisingly, though, many operators on 220 possess no more than the bare bones—a 220 hand-held radio with 1 to 3 Watts output.

Quite often you will hear one of these operators using that same HT from his car, breaking in and out of the receiver with that same 1–3-Watt power level. After being informed that his signal just isn't cutting the mustard, the purchase of an intermediate power level amplifier is the next predictable step. For the infrequent user of 220, the investment in an HT and amplifier might total more than a 25–30-Watt mobile radio. . . but it does offer more flexibility around the station and in the car.

Who makes these amplifiers? There really isn't much of a choice! For the longest time, the only manufacturer of a 25-Watt amplifier for 220 MHz was KLM (now Mirage). The trusty Mirage C22 A (2 W in, 20 W out) has been with us for some time and is a familiar face. I've used one around the shack for about 1 year now for my 220 HTs and have also operated mobile with it on numerous occasions.

But now there's a newcomer to 220 FM. Alinco Corporation of Nevada has introduced the ELH-220GF 20-Watt amplifier with GaAs-FET preamp and rf-sensed switching, all in an attractive package about 6" x 3" x 1". It is designed to take up to 3 Watts input for as much as 30 Watts output, making it attractive as a mobile or auxiliary base-station amplifier. This also puts it in head-to-head competition with the Mirage C22 A! How do the two units compare in performance? Let's start with the Alinco.

Appearance

The case is attractively designed and the controls easy to use. From left to right, they are: MODE (SSB or FM), RX ON/OFF, and TX ON/OFF. The MODE switch selects the time constant for relay dropout between words on SSB (on FM, it is instantaneous). The other controls are self-explanatory. The rear panel uses a 2-pin connector for dc, as opposed to the Mirage C22 A which has permanently wired power leads. Two SO-239 jacks are provided for input and output connections.

The Mirage unit comes close in size, roughly 6" x 3" x 2". It also has three controls on the front—POWER ON/OFF, SSB/FM, and PREAMP ON/OFF. These function the same as their counterparts on the Alinco. Again, two standard SO-239 jacks are employed for input and output connections.

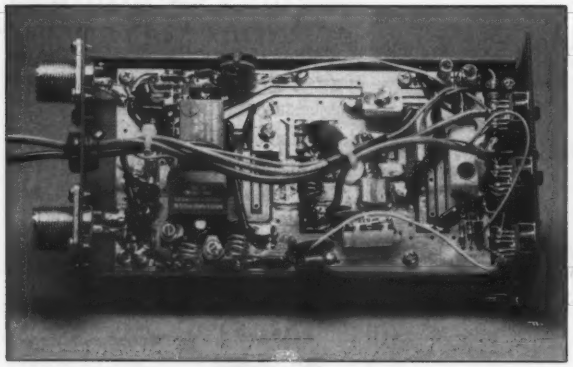
One comment worth noting here: I much prefer the conventional four-hole flange type SO-239 used on the Mirage rather than the single hole threaded type used on the Alinco. Why? Repeated connecting and disconnecting of the cables to the Alinco can cause the nut holding the connector to come loose and it might rotate in the hole. Use of the flange type connector by Mirage eliminates that possible problem.

Both units employ LED indicators to show that the receive preamp is on. The only other LED on the Mirage indicates that 13.8 V dc is present. The Alinco shows this as well but also provides LED indication when actually it is in the transmit mode. Amplifiers are frequently under a seat or in the trunk, so it's a moot point.

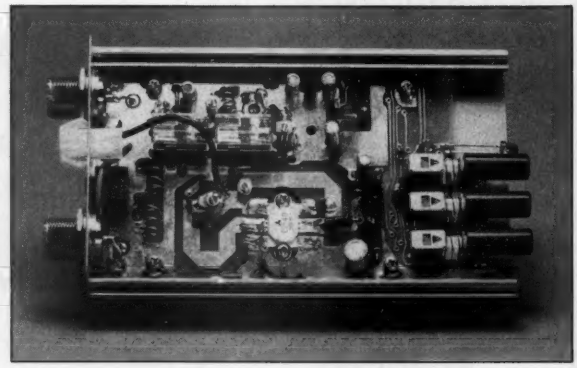
Performance Tests

Now on to the hard numbers. Both units were tested with the usual Hewlett-Packard 8640 RF Signal Generator and 8554 Spectrum Analyzer combination. Table 1 shows transmit linearity—that is, what level of output you could expect for a given input level. Both amplifiers nominally operate at about 10 dB of gain for a given input signal, and the results seem to reflect just that. The Mirage appeared to saturate at about 22 Watts output, while the Alinco reached saturation at 32 Watts output. (Final stages in each amplifier are: Mirage—MRF204A; Alinco—2SC2540.)

Both amplifiers compress (1-dB compression point) at about 2 Watts input. Gain falls off after this drive level on both amplifiers, but the Mirage falls off abruptly, while the Alinco con-



Interior view of the Mirage C22 A.



Interior view of the Alinco ELH-220GF.

Input Level	Alinco Output Power (W)	Mirage Output Power (W)
50 mW	1	1
100 mW	2	2
150 mW	2.5	3
200 mW	3	4
250 mW	4	4.5
300 mW	4.5	5.0
350 mW	5	5.5
400 mW	5.5	6
450 mW	6	6.5
500 mW	6.5	7
550 mW	7	7.5
600 mW	7.5	8
700 mW	8	9
800 mW	9	9.5
850 mW	9.5	10
950 mW	10	12.5
1 W	12	13
1.2 W	14	15
1.5 W	16	17.5
1.7 W	18	18.5
2.0 W	20	21
2.6 W	24	22
3.2 W	26	
4.0 W	28	
5.5 W	30	

Table 1. Input power vs. output power comparisons. The Mirage unit reached saturation at 22 W out. The Alinco unit reached saturation at 32 W out.

tinues to provide almost 10 more Watts of usable output. Overdriving the Mirage results in no additional output but current consumption continues to rise (?).

Spectral purity is comparable in both units, and they meet FCC specifications regarding spurious and third-order harmonics. As far as current consumption is concerned, the Alinco is more efficient—it draws but 3.1 Amps at 20 Watts output; the Mirage requires 4.7 Amps to deliver the same power output.

Since both units employ COR circuits for rf-sensed keying, a logical number to measure is COR sensitivity—otherwise known as the lowest level input signal required to "trip" the COR circuit and put the amplifier in line. Here the Mirage wins out, for it required less than 50 milliwatts of rf to switch on. The Alinco is a bit more insensitive and needs about 100 milliwatts. However, either level is easily below the typical "low power" setting on the average hand-held.

On to the preamplifiers! One gripe I've had in the past with outboard power amplifiers is the poor performance of the preamplifiers that come with them. (So far, the best I've seen have been the Microwave Modules preamps using GaAsFETs and high-performance MOSFETs.) Table 2 shows how the two preamps stack up against each other. Note that while we are sort of comparing apples and oranges—each preamp uses a different type of device, GaAsFET vs. MOSFET—the results are surprisingly similar!

The GaAsFET in the Alinco measured out at 10 dB gain up to an input level of −4.5 dBm, at which point the output started to drop off. This number (called the 1-dB compression point) would be considered fair for a GaAsFET. (A 1-dB compression point of 0 dBm would be good, and above that excellent.) The MOSFET in the Mirage measured out to 9 dB of gain up to an input level of +1 dBm—much better performance.

	Alinco ELH-220GF	Mirage C22 A
Gain	10 dB	9 dB
1-dB Compression Point	+4.5 dBm	+10 dBm
Minimum Discernible Signal in 1-kHz Bandwidth	−122.1 dBm	−120 dBm

Table 2. Here's how the two preamps stack up against each other.

What does this mean to the average user? With a higher 1-dB compression point, the preamp exhibits better linearity and less tendency to compress and "crunch-up" in the presence of a strong signal. Such compression can result in the generation of secondary and tertiary spurious signals as well as mixing products at the preamplifier's output. In this case, it would be less of a problem with the Mirage when operating in the presence of a very strong adjacent channel signal.

Both preamplifiers exhibited better than average sensitivity. The Mirage was able to resolve a signal of −120 dBm in a 1-kHz bandwidth measured on the spectrum analyzer. The Alinco did slightly better, resolving a level of −122.1 dBm in a 1-kHz bandwidth. With these numbers, I wonder why Alinco bothered with the GaAsFET, as a well-designed MOSFET would have done as well.

Operating Impressions

Both units were tested in my Honda Civic over a one-week period, using a direct connection to the battery through #12 wires. The driving sources were alternately a Kenwood TH-31AT and an ICOM IC-3AT. In all cases the antenna used was a Larsen 220-MHz magnetic-mount 5/8-wave gain antenna.

One problem that both units exhibited occurred when the TX power was on and the RX switch (preamp) off, as I transmitted on 2 meters using my Kenwood TR-7400A. The COR relays chattered furiously in the presence of high rf power (25–30 Watts). Why this happened, I have no idea. Possibly rf was picked up from the 2-meter antenna's coax and coupled into the dc power leads of the amplifiers.

Both the Mirage and Alinco performed reliably. In many cases, the preamps proved to be a boon, as 220-MHz propagation changes can be quite abrupt, resulting in rapid picket-fencing on weak signals. The preamps alleviate this to a great deal, and don't appear to exceed the transmit coverage. In all cases I employed FM mode, so the keying was always solid. I tested both units off the bench with a low-level SSB signal using delayed drop-out keying, but still prefer hard keying in SSB or CW mode. Neither amplifier offers this option, though.

The two units are so small you can tuck 'em away almost anyplace—real important in the smaller imported cars. If you choose to use them while mobile, I'd suggest making up a pigtail out of RG-8/X from your HT to the amplifier, and use a 90° BNC connector on the HT to allow the cable to swivel, reducing strain on it. Avoid 1/4-wave or multiples thereof in the length; aim for 1/2- or full-wave multiples. Although both amplifiers exhibited a good impedance match at the input (better than 1.3:1), it can't hurt and might squeeze a few more Watts out.

Drumroll

Now—the envelope please. And the winner is . . . Alinco, but by the slimmest of margins. It all came down to this: The Alinco could be driven with up to 5 Watts and delivered 30+ Watts for the effort, while the Mirage mysteriously leveled off above 2 Watts drive. While the Mirage had the better preamp, the ultimate criterion for making the decision is how well the amplifier amplifies. In almost every other department the two units came up almost even.

Reader Service numbers: Mirage 201; Alinco 202.■

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73 Review

Dick Smith 100-Watt VHF Amplifier Kit

by Allan J. Perrins WB6PHE

Dick Smith Electronics
PO Box 8021
Redwood City CA 94063
Price class: $150

Number 12 on your Feedback card

Sometimes a little more power is all that you need to access a distant repeater or to make that DX contact How about a lot more power—say 110 Watts or so for 10 Watts in? Need more mobile power with your hand-held? Would 43 Watts out for 2 Watts in make a difference? If you're willing to save a few bucks by spending a few hours with a soldering iron, the Dick Smith 100-Watt VHF amp kit will definitely fill the bill.

Appearance

The completed unit looks very professional. In fact, the only external giveaway that it is a kit will be the lack of pop-rivets holding the case together! All case parts are black anodized, as is the large heat sink (the photos are of a prototype, which had aluminum panels). Front and rear panels are silk-screened with control and connector nomenclature. Rubber feet are provided for base-station use, but as usual with amplifiers, no provision for mobile mounting is made. Fortunately, no parts mount to the bottom of the case and it may be drilled for mobile use. UHF connectors are provided for transceiver and antenna connection.

Circuit Analysis

As with most power amplifiers, there really isn't too much stuff in the box. The heart of the unit is a pair of Mitsubishi 2SC2694 transistors, each rated at 75 Watts. T-R switching is handled by a pair of low-loss coaxial relays, accounting for the low 0.6-dB insertion loss in receive. There is a third relay used to switch power on and off to the power transistors and to the "on air" light. In this way, current consumption during receive is held to about 50 mA, primarily because of the meter lamp. In the SSB/CW mode, the amp stays "on" for a short time after carrier sensing drops out due to the nature of SSB and CW transmissions.

Construction

As in many of the Dick Smith kits, the manual is a reprint of an *Electronics Australia* article. This one was run in March, 1986. Be prepared to read it several times and to translate it from Australian to "American." It is, however, unfair to compare the Dick Smith kits with the ones from our old friends at Benton Harbor. If you consider the Dick Smith offerings as "projects" instead of kits, the level of documentation becomes more tolerable. It is assumed that the builder has some knowledge of rf circuitry and construction practices.

The lay ham should have no trouble with this kit/project, however, as the manual/article contains all the necessary information if you're willing to dig. For instance, page 4 of the manual/article directs you to cut the supplied brass shim stock into specified strips and fit it to the PC board "as shown in Fig. 2." I'm sorry, but if you've never built a power amp before, it doesn't make any sense. But if you refer to Fig. 9 on page 7, the fitting of this shim stock becomes clear—it ties the top and bottom ground plane of the PC board together right at the rf transistors.

This hurdle passed, the remaining construction is pretty garden variety. Be sure to refer to Fig. 5 for proper orientation of the variable caps, as the adjustment screws will have high rf voltage if they are installed backwards. You'll have to wind a few coils—no sweat, make them just as they appear in Fig. 7 and you won't go wrong. Remember, the dimensions are in millimeters! Instead of gluing the meter to the front panel, you could fashion "brackets" made of stiff wire soldered to the inside of the front panel. Fortunately, there are lots of good photographs to assist the builder in case of confusion.

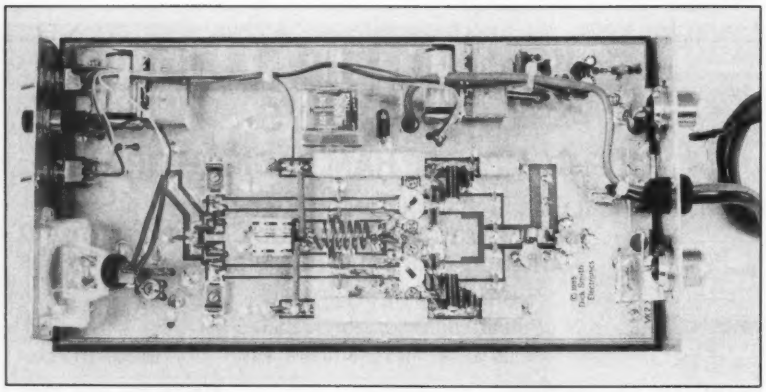
Alignment

If you don't have the specified equipment, beg, borrow, or steal it! You run a real risk of blowing up the rf devices if you try to "wing it." The preferred test setup would be a vswr bridge between the radio and amp and a wattmeter on the amp output terminated in a proper load. An antenna is not a proper load! Assuming the unit was constructed properly, follow the instructions and you should be on the air in 15 minutes or less.

Summary

There is enough room in the case for a receive preamp, but with a measured 0.6-dB insertion loss, I felt that I didn't need it. The heat sink gets warm during prolonged operation, but the power output automatically shuts back as the temperature goes up as a protection measure. Make sure that your load is properly matched, as high vswr will only make the amp run hotter and shorten the life of your rf transistors. If you run the amp mobile, be sure to use heavy cable—the current draw is substantial.

For about a buck and a half a Watt, it's a lot of amp for the money. Besides, if it ever goes out, you'll be able to fix it yourself! ■



A look inside the DSE 100-Watt VHF amplifier.

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WHAT ELSE DOES IT TAKE TO GET ON ATV?

Any tech class or higher amateur can get on ATV. If you already have a source of video and a TV, it costs about the same as getting on 2 meters. Now you can be seen as well as heard.

DX with TC70-1s and KLM 440-27 antennas line of sight and snow free is about 22 miles, 7 miles with the 440-6 for portable use such as parades, races, search and rescue, etc. You can add one of the two ATV engineered linear amps listed below for greater DX.

AT 70 cm, antenna height and gain is all important. Foliage can absorb much of the power. Also low loss tight braided coax such as the Saxton 8285 must be used along with type N connectors.

The TC70-1 has full bandwidth for color, sound, and computer graphics. You can now show the shack, computer programs, home video tapes and movies, repeat SSTV or even space shuttle video if you have a Home Satellite Receiver.

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50 WATT WITH D24N-ATV....$499

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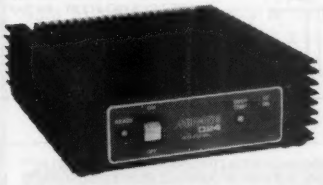

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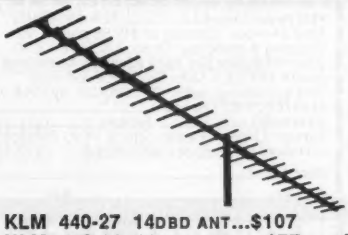

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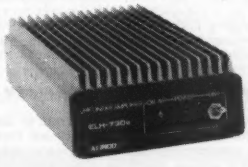

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Heath IP-2760 Battery Eliminator

Heath Company Dept. 011-442 Benton Harbor MI 49022 Price class: $180

Number 13 on your Feedback card

by Perry Donham KW1O

One accessory that you'll find in every ham's shack is a power supply. Some are fancy with cases to match a particular transceiver, others are general-purpose units in military-looking boxes, and there's always the home-brewed job with the 40-pound surplus transformer.

I needed a reliable 12-volt supply that could handle 10–15 Amps, and decided to try Heath's IP-2760 Battery Eliminator. The IP-2760 will run at 12 Amps forever and can deliver up to 20 Amps on peaks—perfect for my HF station.

The Circuit

As power supplies go, the IP-2760 is pretty simple. A full-wave bridge rectifier is followed by 20,000 microfarads of capacitance; voltage is then passed to an LM-317 monolithic regulator. Four hefty pass transistors provide the current-handling capability. The LM-317 is an adjustable regulator and is set up in this circuit to deliver 8–15 volts with less than a 2% drop in voltage when a load is applied. Output ripple is held to under 1%.

Two front-panel meters are provided to monitor output voltage and current. In addition to the on/off switch, a standby/operate toggle is included—handy if you want to use the supply for testing. Two color-coded banana jacks connect the unit to the rest of the world. The case is Heathkit blue with a white face, and two handles on the top make this a "portable" power supply (it weighs about 20 pounds).

Construction

It took about five hours to put the IP-2760 together. Most of the time was spent stripping wire and building the .09-Ohm, 20-Watt resistors for the pass transistors (four sets of four .33-Ohm, 5-Watt ceramic resistors wired together on two long terminal strips). As usual, there was plenty of material supplied in the kit, with quite a bit of wire left over.

"I ended up glad for the minute detail when it came time to really start hooking things up."

The remainder of the five hours was spent trying to get the little plastic strain relief for the power cord to fit into an even littler hole on the back panel. Now, I've seen these things go right in with no sweat, but it was always somebody else doing the work. I have *never* been able to get the buggers in without completely destroying them. And the manual just mocks me: "Place the line cord in the slot. Squeeze the two segments together. Insert the rear half into the hole." *As if it were that simple!*

Everything else went smoothly, although be very careful when you handle the finned heat sinks which attach to the sides of the chassis. They are *very* sharp. All of the transistors are socketed, and a generous amount of thermal compound is included. I was a bit concerned about the plastic covers used on the transistors, but they seem not to be harmed when the supply is running full out.

During construction, I kept wondering whether or not I could go faster if I just ignored the step-by-step instructions. Especially with a project this simple, all of the "Connect one end of the 12" black wire to Q6 lug C" instructions tend to get tedious. I stuck with it, though, and ended up glad for the minute detail when it came time to really start hooking things up. Wires that had been cut to a specific length were (of course) just the right size to reach to tab C, and everything fit perfectly.

I did, however, end up ignoring the instructions regarding bending wires. In many cases a wire is to be bent to a particular shape to make it from one connection to the next; I found that I couldn't manage to pre-bend the wire and have it fit. It was no big deal, I just bent one end and then measured the distance by holding it up to the circuit.

I also was a bit put off by instructions that had you solder a wire into place on one end and then remove an additional amount of insulation from the other end. This places unnecessary stress on the solder joint, so I simply stripped the wire before it was soldered.

Summary

I've built several Heath kits in my years as a ham, starting with an HW-16. They always work. The IP-2760 started right up, and the measured voltage matched the published specifications. It costs a bit more than most power supplies in its category, but I think that the pleasure of putting it together and the ability to repair it yourself are well worth the additional cost. I think that you'll find the IP-2760 a useful addition to the shack, whether you use it as a dedicated power supply or a test-bench voltage source. ■

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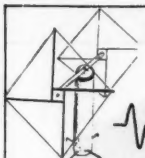

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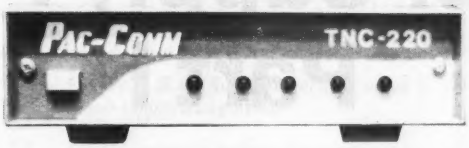

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A Power Supply Primer: Part I

Without a well-regulated and reliable power supply, your state-of-the-art rig will work just about as well as a megaphone.

Number 1 on your Feedback card

No matter how you cut it, the dc power supply is of critical importance to the success of any construction project. It's easy to understand how a project needs correct dc power to operate—about that there is little argument. But what about reliability? The dc power supply is unfortunately the last thing thought of by both amateurs and professional designers. Let me make a few points in that regard.

Point One. During a time when I worked repairing medical equipment at a major hospital, records were kept regarding all repairs. It was found that (over a six-month period) 36 percent of all failures were in the dc power supply either as primary or secondary failures. No other single kind of failure even approached the power-supply failure rate.

Point Two. Several well-known amateur radio transceivers suffered excessive downtime due to underspeced power-supply rectifiers. Once the amateurs involved followed the derating advice that will be given in this series, the reliability problem went away (except on Field Day, when all bets are off!).

Point Three. While working for the Food and Drug Administration, I had to examine reports of excessive failure in a certain medical device (fortunately not a piece of life-saving equipment). More than half of the failures reported for that equipment were either rectifiers, filter capacitors, or voltage regulators in the dc power supply—the designer overlooked some elementary design rules which even a novice could appreciate and follow!

Point Four. The US Naval Material Command, recognizing that low-voltage dc power supplies in Navy equipment are a major source of reliability problems, issued tough new guidelines for the design of supplies in military electronic equipment.

Clearly, the design of dc power supplies is a nontrivial matter when considered from a suitability and reliability point of view. In this article and those to follow, we will discuss the proper design of small dc power supplies for amateur and hobbyist applications. In order to keep the arithmetic to a minimum, we will use "rules of thumb" which are proven effective in some cases. We will also provide several Basic computer programs to assist in working some of the arithmetic.

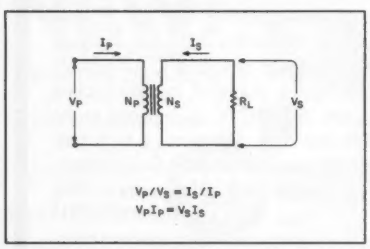

Fig. 1. The transformer is essentially a voltage converter.

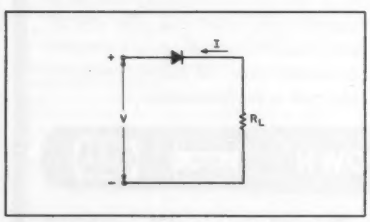

Fig. 2(a). Forward-biased half-wave rectifier.

Basic Elements of the Dc Power Supply

The basic dc power supply consists of the following elements: *transformer, rectifier, filter,* and sometimes *voltage regulator.* Also included in some dc supplies are the following features: *overvoltage protection, current limiting, fusing, transient protection,* and various *status indicators.* In the sections to follow, we will discuss each of these.

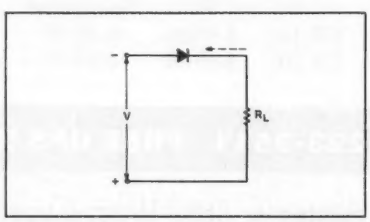

Fig. 2(b). Reverse-biased half-wave rectifier.

Transformers

The transformer (Fig. 1) is essentially a voltage converter. It changes the standard line voltage (115 V ac in the U.S.) to a higher or lower voltage required for the operation of electronic circuits. In some other cases, the transformer will be used for *isolation* and will deliver the same output voltage as is applied to the input. The main use of these transformers is *safety.* Many electronic appliances (especially but not universally those marked "ac/dc") are unsafe when operated either out of doors or in a "grounded environment" indoors (e.g., in the cellar on a concrete floor).

Most of the transformers which we will consider are *step-down* types because solid-state electronic circuits typically operate from lower voltages. The "typical" range for most projects is 1.5 V dc to 30 V dc: Linear ICs tend to require ±4.5 V dc to ±18 V dc; CMOS digital circuits use ±4 V dc to ±15 V dc; TTL digital circuits require 0 and +5 V dc (regulated); transistor circuits require the entire range given above. Some integrated circuits fall outside of the ranges above, but the limits are proper for most devices.

Because the transformer is very efficient, stepping the potential down in the secondary winding increases the current available for

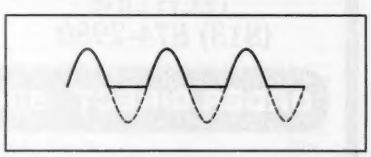

Fig. 2(c). Output waveform of a half-wave rectifier.

any given voltage level (the opposite is true for step-up transformers). The primary volt-Ampere (VA) rating (volts x Amperes) is very nearly equal to the VA rating of the secondary. Simply stated: $V_{pri} \times I_{pri} = V_{sec} \times I_{sec}$, where: V_{pri} is the voltage applied to the primary winding, V_{sec} is the voltage appearing across the secondary winding, I_{pri} is the current flowing in the primary winding, and I_{sec} is the load current drawn from the secondary winding.

In most transformers, the primary winding is closest to the core and so is not able to dissipate heat to the air as well as the secondary winding. As a result, the limiting factor for the transformer is the *primary VA rating*. This rating should not be exceeded, or low reliability will result. As a matter of normal procedure, I prefer to specify the primary VA rating at not less then 120 percent of the expected power requirement for applications that are analogous to the "intermittent commercial and amateur service" (ICAS) ratings given for vacuum tubes (Watts = volts x Amps).

Where service is continuous or where the environment is hostile (which usually means heat dissipation is limited), then I prefer to specify a VA rating that is 200 percent of the power requirements. In other words, if a project will draw 3 Amperes at 6.3 volts (P = 3 x 6.3 = 18.9 Watts), then I would look for a VA rating of 23 for ICAS-type service or 38 for critical service. These figures translate into secondary current ratings of greater than 3.7 Amperes and greater than 6 Amperes, respectively.

In general, for ICAS-type service, military transformers can be operated at secondary currents greater than the marked values because they are normally derated considerably. I would not recommend pushing these ratings for critical service, however.

Rectifiers

The rectifier converts the alternating current from the secondary winding of the transformer into pulsating dc. The output of the rectifier is not the "pure" dc which we would obtain from batteries, but it is at least unidirectional and can be "filtered pure" (well, almost pure). The simplest form of rectifier is the half-wave rectifier.

All rectifiers operate on the same principle, whether they are vacuum tube, mercury vapor tube, cold cathode gas tube, or solid-state PN junction diodes (or even "mechanical rectifiers," which the old-timers will remember): They produce unidirectional current from bi-directional ac current by virtue of *conducting current in only one direction.* When an ac sine wave is applied to the input of this circuit, current passes through the rectifier only when its anode is more positive than its cathode, as in Fig. 2(a). On the other half of the ac cycle, Fig. 2(b), the rectifier is reverse-biased and so will not conduct electrical current through load R_L.

The waveform associated with the half-wave rectifier is shown in Fig. 2(c). This waveform appears across load resistor R_L. Note that the waveform exists only when the

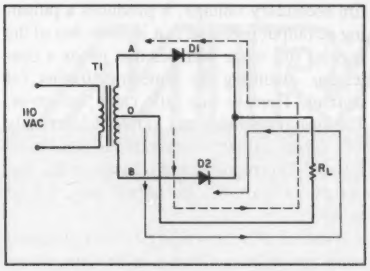

Fig. 3(a). Basic full-wave rectifier using a center-tapped transformer.

input waveform is positive; the negative half-cycle is lost. Since half of the cycle is not used, the half-wave rectifier is wasteful of energy.

The half-wave rectifier has an average output potential that is approximately 45 percent of the applied rms potential, and its "ripple" amounts to 120 percent. To add to the problems of this design, the transformer used must have a primary VA rating that is 40 percent higher than is required if the entire cycle were used (as in full-wave rectification).

A basic full-wave rectifier using a center-tapped transformer is shown in Fig. 3(a). At any given ac peak voltage, one end of the transformer secondary is positive while the other end is negative. The center-tap is at a potential that is half that found across the entire secondary. Therefore, if the center-tap is used as the common reference voltage, then equal and opposite polarity potentials are found at either end of the secondary with respect to the center-tap.

Let's consider the case when the top of the secondary is more positive than the bottom. Current flows from the common center-tap through load resistor R_L and forward-biased diode D1 (whose anode is more positive than the cathode) and then back to the transformer secondary winding. During this period, diode D2 is reverse-biased due to the negative potential on its anode, so no current flows in D2.

On the alternate half-cycle, diode D1 becomes reverse-biased and D2 is forward-biased. Current then flows from the center-tap

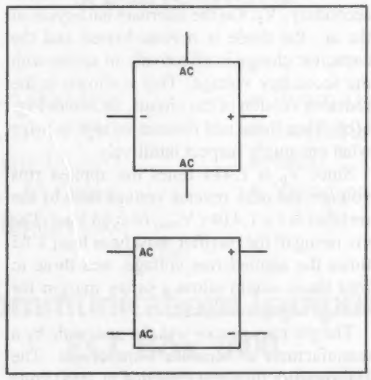

Fig. 5. Circuit symbols for integrated bridge-rectifier assemblies.

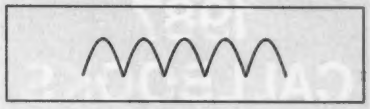

Fig. 3(b). Characteristic double-humped waveform of full-wave rectifier.

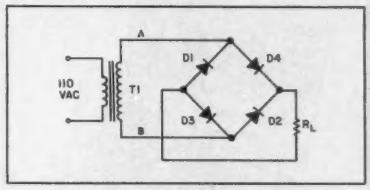

Fig. 4. The bridge rectifier requires no center tap on the transformer.

through R_L and diode D2 back to the transformer secondary.

Note that in both cases the current flows in the *same direction* through load resistance R_L. This action produces the characteristic "double-humped" waveform across R_L shown in Fig. 3(b). We can say the negative half of the ac cycle is "folded up" to the positive side of baseline by the switching action of the diodes.

Another form of full-wave rectifier is the "bridge-rectifier" circuit shown in Fig. 4. It employs a diode "ring" (D1 through D4) for rectification. The secondary of the transformer is not center-tapped because the diode ring provides the negative (and sometimes grounded) zero reference point. The two "corners" of the bridge circuit labelled "–" and "+" go to the positive and negative dc outputs of the power supply or to the same polarity points on the filter capacitor.

Although some designs use individual rectifiers for D1–D4, the trend today is to use a bridge "stack" that includes all four diodes in one package. Fig. 5 shows two common circuit symbols for these devices.

Since the bridge rectifier employs the en-

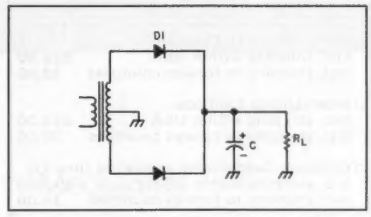

Fig. 6(a). Capacitor C smooths out the pulsating wave.

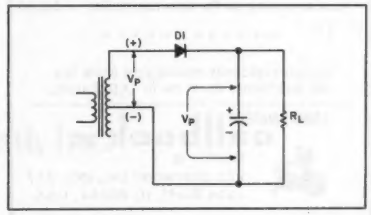

Fig. 6(b). This is what D1 sees on the alternate half-cycle.

1987 CALLBOOKS

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Continuing a 66 year tradition, there are three new Callbooks for 1987.

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tire secondary voltage, it produces a pulsating dc output potential that is *twice* that of the regular full-wave rectifier that needs a center-tap, assuming the same transformer (of course). There is one little catch, however. The bridge rectifier can safely deliver only half of the output current from that transformer! This requirement is based on the fact that the primary VA rating still must not be exceeded.

If the transformer employs a center-tapped secondary winding then it is an almost sure bet that the manufacturer rated the device for regular full-wave—not bridge—service. We can use that transformer for bridge service, but we should accordingly derate the output current by one-half. If the transformer is not center-tapped, then it was probably designed for bridge-rectifier service and can be used at the full rated current.

The average dc potential across an unfiltered full-wave rectified power supply (bridge or otherwise) is approximately 90 percent of the applied rms potential. Full-wave supplies produce 48 percent ripple, which is a lot less than half-wave circuits but still requires filtering. Since both halves of the ac cycle are used, the ripple frequency of a full-wave supply is twice the line frequency, or 120 Hz for a 60-Hz power line; half-wave ripple frequency is the same as the power-line frequency.

Rectifier Specifications

Solid-state rectifiers are generally reliable devices. Premature failure of rectifiers is usually due to improper specification by the design engineer. There are two principal rectifier specifications of concern to us: *peak inverse voltage*, or piv (also called *peak reverse voltage*), and *forward current.*

Peak Inverse Voltage

The peak inverse voltage is maximum reverse-bias potential that the rectifier can sustain without damage. It is this specification that seems to give the most trouble. The problem is that many designers fail to recognize the actual reverse voltage in a circuit that contains a reactive element like a filter capacitor. Most filters use a capacitor across the output of the rectifier, as in Fig. 6(a). This filter charges to the peak voltage across the secondary, V_p. On the alternate half-cycle of the ac, the diode is reverse-biased and the capacitor charge is effectively in series with the secondary voltage. This is shown in the redrawn version of the circuit, shown in Fig. 6(b). Thus the actual reverse voltage is *twice* what one might suspect intuitively.

Since V_p is 1.414 times the applied rms voltage, the peak reverse voltage seen by the rectifier is $2 \times 1.414 \times V_{rms}$, or $2.83\ V_{rms}$. The piv rating of the rectifier must be at least 2.83 times the applied rms voltage, and three to four times would allow a safety margin for voltage rating tolerances.

The piv rating error was the one made by a manufacturer of amateur transceivers. The HV rectifier diodes were rated at 1000 volts piv, and the applied voltage was 450 V_{rms}. Thus, because of the filter capacitors, almost 1300 volts were applied to those diodes in the reverse direction, and the result was new diodes and blown fuses every few months!

As a general rule, it is wise to use 1000-volt-piv diodes for all applications up to 300 volts rms, including low-voltage power supplies. In the 1-Ampere size, the 1N4007 is a good choice.

Forward Current

The forward current rating of the rectifier is the maximum sustained current that the device will pass in the forward-biased direction. Do not confuse this rating with the surge current rating, which is much higher. There might be a 25X factor between the two ratings. In other words, a 1-Ampere diode might have a surge current rating of 25 Amperes or more. This rating is the current that is tolerated by the diode for one cycle of the ac input waveform, or less than 17 milliseconds at 60 Hz!

In some cases, there has been a little, er, uh, creative spec writing on the part of *some* rectifier vendors. Since amateurs and hobbyists can often use ICAS-type ratings, they tend to rate the diode at twice the real forward current rating—especially in the over-1-Ampere category of devices. Thus, I can recall seeing a diode marked with a type number that Motorola claimed was rated at 1.5 Amperes being hawked in a local dealer as a 3-Ampere device! Since Motorola made the thing, I tend to trust their label over that of a surplus rebrander.

In the case of bulk-packed "bargain" rectifiers, the forward current rating is an out and out lie—not merely an almost-reasonable stretching of the truth. The lack of a type number or recognizable semiconductor manufacturer's logo generally betrays these devices. If the rectifier is of uncertain parentage, then be suspicious and derate them by 50 percent or more (in other words, consider a "1-Ampere" device to be a 500-mA rectifier). Since I prefer to specify rectifier forward current at twice (or more) the expected normal maximum load current, these devices should be rated by you at one-fourth the load current.

When you actually mount either a replacement (in case of repair) or an original rectifier, be sure to give the device plenty of breathing room—it gets quite hot. Axial lead rectifiers should be mounted 1/4" from the surface of the printed circuit board, while stud-mounted rectifiers should be mounted on heat sinks. Bridge stacks intended for PC-board mounting should also be mounted with breathing space between them and the board. When laying out a new project, do not mount the rectifier in close proximity to heat-sensitive circuits such as oscillators, amplifiers, and so forth. If an already-built circuit seems unstable with respect to temperature and the rectifier is mounted close to sensitive components, suspect the rectifier as the problem.

Looking Ahead

In the next installment of this series, we will discuss filter circuits for simple low-voltage power supplies. ■

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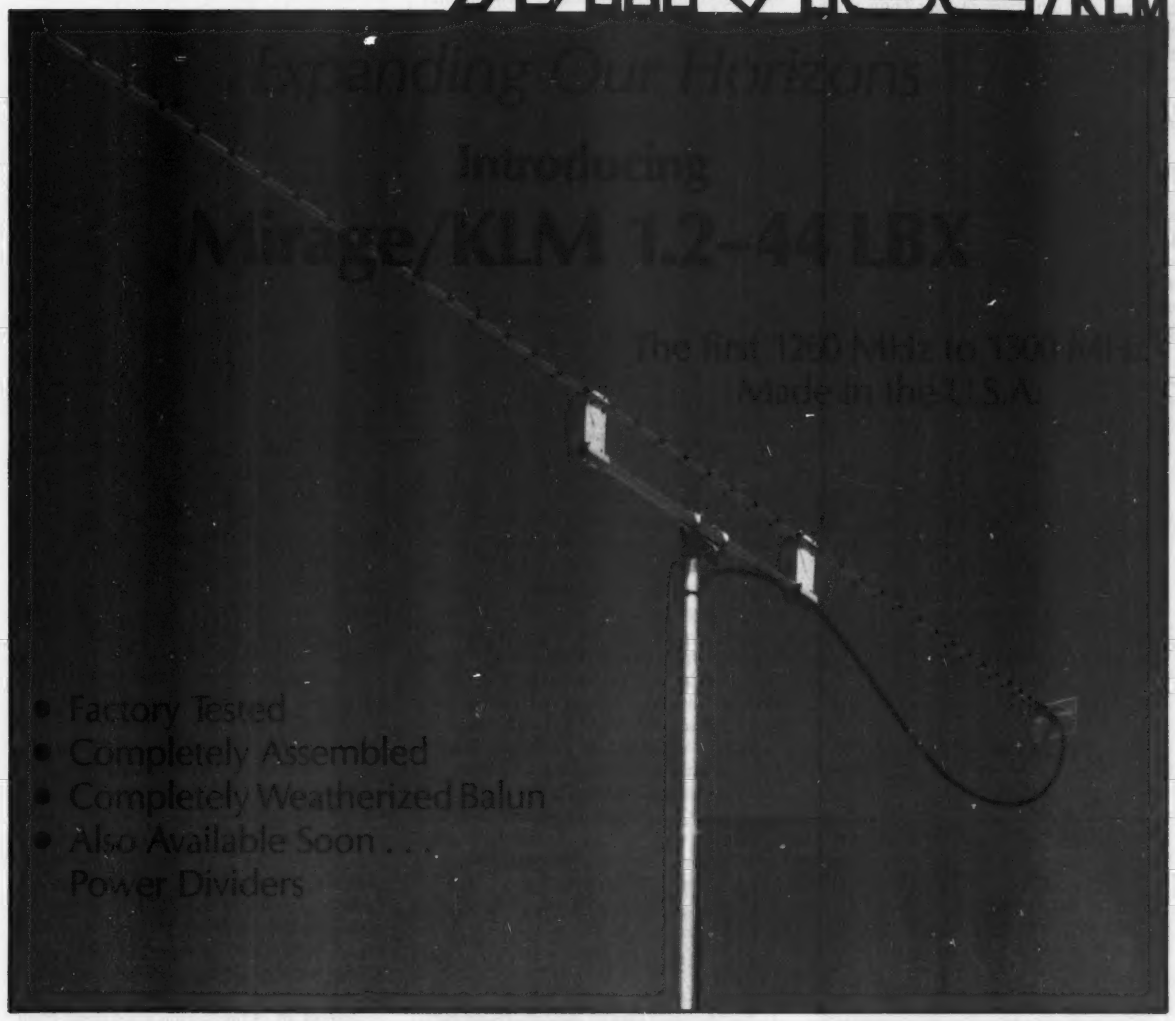

SPECIFICATIONS

Electrical

- Band Width ..... 1260–1300 MHz
- Gain 18.2
- VSWR ..... Better than 1.5 to 1
- Feed Imp ..... 50 Ohms
- Balun ..... 4:1 Rigid Coax

Mechanical

- Beam Length ..... 12' 4"
- Element Length ..... 4.5"
- Mast ..... 2" O.D.
- Windload ..... 1 sq. ft.

91

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Born-Again Bargain Boards

It's magic! Turn scrap PC boards into an electronic library of pre-etched building blocks.

Number 2 on your Feedback card

I was visiting my friend Bob in his basement ham shack one evening, and I was enjoying myself watching him rummage around in his junk pile as he tried yet again to shrink it to a manageable size.

"Hey, what are those?" I asked as he retrieved a dusty box from beneath a workbench and hauled it toward the basement bulkhead on his way to the trash can.

"It's a lifetime supply of PC boards," Bob said, "all unused, no components, just etched boards."

"Gee, it seems a shame to just throw them away," I said. "There must be something they could be used for."

"What, square Frisbees? Shingles for a leaky doghouse? What earthly good is a PC board somebody else has etched?" Bob laughed. "They've kicked around under my bench for years, and I never did anything with them. Here, you want them? Take them away!"

That's how I wound up with 20 pounds of assorted "pre-etched" circuit boards, a term akin to "pre-owned automobile." Somewhere, some hapless company had made a mistake and ordered too many PC boards for its needs, or perhaps a PC board designer made a few layout errors. It's also possible that the artwork for the board was revised and the old-generation boards were junked, or that the boards were rejected by quality assurance.

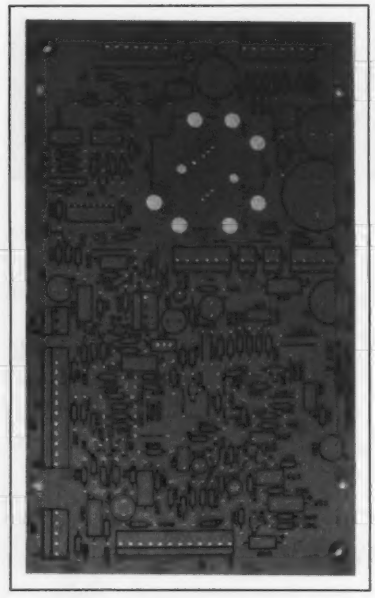

Photo A. Component side of the "Tuner Interface" analog PC board. The power supply section is in the upper right portion of the board.

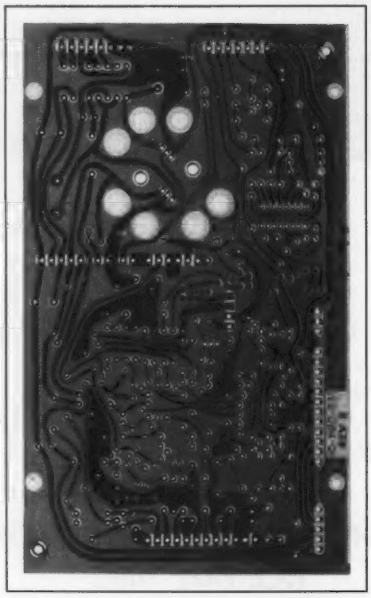

Photo B. Foil side of the "Tuner Interface" analog PC board. The power supply section is in the upper left portion of the board.

Sorting Through the Boards

In any case, what kind of silk purses could be made from this collection of electronic sow's ears? I began by sorting through the boards: Bob had assembled a fine assortment of PC boards, that was for sure.

I divided the boards into two general classes: digital and analog. The digital boards were characterized by large numbers of integrated-circuit DIP pad patterns arranged in neat rows. The analog boards had a few DIP patterns, but most of the pads were laid out in an irregular fashion.

Most of the digital boards were two-sided, with traces on both sides; a few boards were of multilayer construction. When I held these to the light, I could see a dark inner layer which didn't correspond to the traces on either surface of the board. Many of the analog boards were of single-sided construction.

Almost all of the boards were made from the familiar green-colored epoxy-fiberglass material that is widely used in industrial and military electronics. A few of the analog boards were made from a tan-colored epoxy-paper laminate. There were even one or two boards made from brown paper-phenolic material; this stuff was used in huge quantities for consumer goods. Its most notable features are a barnlike smell when it's overheated and its tendency to lose traces when a soldering iron is applied for too long. I threw these boards away.

The Digital Boards

I selected a double-sided digital board for my first experiments. The board was approximately six inches by nine inches and it had pads for approximately 30 integrated circuits, all of 14- and 16-pin sizes. There was a nice gold-plated edge connector on one end and pads for test points at the other.

While traces snaked every which way between IC locations, there was a power bus pattern that ran to the corner pads of most of the IC locations. If I could remove all of the traces except the bus, perhaps I could use the card as a breadboard.

I plugged in the soldering iron and, while it was warming up, I fitted a new, sharp blade into an X-acto® knife. I selected a PC trace at random and cut through the copper close to the IC pad at each end. I held the hot soldering iron onto one cut end of the trace and simultaneously pried up the trace's end with the knife.

Next, I grabbed the raised end of the trace with a pair of needle-nose pliers and pulled. Zzzip! The trace peeled cleanly away from the board and left a ghosty trail on the board to mark its passing.

I fell into a steady rhythm: Cut both ends, heat and slightly lift one end of the trace, and then peel away the traces when a bunch were ready. There were a couple of hazards: It was essential to use a sharp blade in the X-acto knife, and the exposed edges of the peeled-away copper traces were razor-sharp and capable of dealing exquisite "paper" cuts.

When all the signal traces were stripped away, I installed wire-wrap IC sockets and soldered their pins to the power bus pads and two corner pads for mechanical strength. Locations for bypass capacitors were already pre-etched next to each IC, and the junk box yielded a matching edge connector. The board was ready to be wrapped.

Was the time required to strip away the traces well spent? Yes, I think so. Thanks to its power buses and good ground plane, the board would be electrically less noisy than a totally wire-wrapped equivalent, and its cost was much less than a commercially available bus board.

The technique works best for small, double-sided PC boards that are laid out in an open fashion. Multilayer boards are unsalvageable if signal traces are buried in the inner layers; if the inner layers are the power and ground planes, the board may be usable. Also, avoid densely packed, large boards with more than 30 IC locations. The larger boards are harder to work with and are less useful for small projects.

The Analog Boards

Next, I turned my attention to the pile of analog boards from Bob's junk box. At first glance, these boards seemed less useful than the digital boards. There was no regular power-distribution bus, nor were there many DIP locations. There were dozens of identical boards, however.

One board caught my eye: It was a single-sided board that measured about five by eight inches. Its top surface was silk-screened with component outlines and the words "Tuner Interface" (Photo A). The pattern of copper paths on the reverse side (Photo B) was simple enough to trace into a schematic, but why bother?

After staring at the board for a few minutes, however, I noticed an interesting pattern: The outlines of electrolytic capacitors marked with polarity symbols, diodes, and a heat sink were visible in the silk-screened markings. Whatever the board's ultimate function was, it included a power supply section with IC voltage regulators.

Power supplies are basic building blocks common to almost every project, and it's time-consuming to lash one together from scratch. The circuitry doesn't vary much from design to design: There's always a rectifier and a filter capacitor, and often a three-lead voltage-regulator IC of the 78XX family.

The chances were good that the designer of the board used the same building blocks in his power supply. I spent a few minutes tracing etch and discovered that he had. I could install my own components, ignore or cut away the unwanted circuitry on the board, and have a regulated power supply building block for future projects. There were two dozen boards in the pile, so I had a lifetime supply.

Tracing the power supply wasn't hard, so I turned my attention to the rest of the board. Could I figure out what it was used for and perhaps determine what components were used? The low density of components and single-sided construction suggested that the board had been built for use in a consumer product, perhaps a projection television receiver.

I selected a DIP IC location on the board as a starting point and systematically examined all traces going to its pins. Two traces made their way back into the power-supply section, and by examining the polarity markings on the silk-screened capacitor outlines, I was able to determine which IC pin received positive voltage and which was grounded.

With that information, I began a search for a linear IC whose pins matched my findings. I selected a data book and reviewed common operational amplifiers and comparators: no dice. Next, I looked through the consumer IC section of the data book: again, no luck. I switched to another vendor's data book and repeated the process: bingo! There, on page 792 of the RCA linear IC data book was the CA3159E, a "horizontal processor and agc detector" device.

The data book included a functional block diagram of the IC and an application circuit, so I was able to identify the input and output pins that were being used. A little more tracing of PC patterns and I discovered that only the agc portion of the chip was being used. With a little effort, the circuit could be adapted to other functions. I had added another potential pre-etched "building block" to my collection.

Helpful Hints

I found a couple of techniques very helpful to the process of tracing PC patterns. When an etched run has been followed to its ends, it's a good idea to mark the run to avoid confusion. I found that a Pilot ultra-fine point permanent marker, type SC-UF, worked well and semi-permanently marked both copper traces and fiberglass. The marker's fine, sharp point also made it possible to write part numbers on the circuit side of the board. Alcohol or solder-flux solvent will remove the ink.

It's also helpful to mark the beginning and end of a trace and then flip the PC board over to see what components are in the vicinity. I took a pair of plastic-headed map pins and blunted their points. It was easy to poke the pins through the trace's beginning and ending holes and then reverse the board.

Once you have identified the function of a PC board or a portion thereof, you can choose to attack the board with a nibbling tool or a bandsaw and cut out the interesting part. Avoid breathing the dust from a glass-epoxy board because it's an irritant and a good substitute for itching powder. Make sure that you haven't introduced any short circuits due to copper burrs when you made the cuts.

Choosing the Boards

If you should find a batch of boards for sale at a flea market, look them over carefully before you decide to buy them. Make sure that the boards have been fully processed. Avoid those that have bare copper traces or chemical residue stains. Some boards have had their gold-plated contact fingers clipped away. These boards may still be useful if an IC location is used as a connector site.

The most desirable boards will have their function and component part numbers silk-screened on the component side of the board. Unlabeled boards, "mystery" boards, and large digital boards are less useful. Do not spend much money on any bare board. Remember, you're buying someone else's mistake and you still have some detective work ahead.

Is it worthwhile to salvage unused PC boards? In general, yes, if you can identify a basic building-block function that you can use. The more boards of a useful type you have, the better, because your research time has a larger payoff.

Don't overlook the educational benefits of pitting your reverse-engineering skills against an unknown designer's efforts. The secret is to take advantage of what would otherwise go to waste and make it useful to you. ■

FIVE BUCKS FOR FIVE BOARDS

A package of five circuit boards is available from the author for $5 ppd. The boards are of mixed sizes and shapes and are representative of the types discussed in this article. Send a check or money order to: Brad Thompson, 77 Waltham Street, Maynard MA 01754.

Terry F. Staudt W0WUZ
4807 S. Blue Spruce Road
Evergreen CO 80439

Defuse RFI

A couple of caps and some coax put an end to crisped lips and cruddy audio.

Number 3 on your Feedback card

The response to "Lightning Never Strikes" in the August, 1986, issue was so great that we decided to reprint this W0WUZ classic from 1983.—Eds.

As a long-time denizen of 10 meters, I have learned along with my like-minded compatriots to suffer when the band is really running well and our friends from 80, 40, and 20 come up to partake of the fun and games. Suffer? You bet!

A ground wire is totally ineffective over 1/8 wavelengths on the frequency in use. Dc yes; rf no. This works out to about 4 feet on ten. I realize it is extremely difficult to achieve a situation where your ground wire is 4 feet or less, *to the earth*, not the toilet!

Another problem (coincidental with the above) is rf feedback in the TX audio, which in its least annoying form makes your voice sound like vibrating chicken wire and in its worst sends spurs running 100 kHz up and down from your central frequency (or from dc to daylight, as we used to say in Navy ECM).

For considerably less than $5, there are steps to take that can result in hearing, either while in QSO or afterwards when the station you worked is talking with someone else, "Lord, the guy in _____ had beautiful audio!" These measures are not new, but like so many other pieces of hands-on know-how, they need to be repeated and correlated every now and then to refresh and instruct those who don't read electronics books on the john.

If your rig is in the basement, effect a 1/2" 45° hole in the wall with a masonry bit or star drill and drive a 6-to-8-foot ground rod, leaving about 5 inches protruding. Seal with waterproof putty or silicone. Properly placed, this will give you about a 1-foot ground connection. For those not in the basement, a coaxial ground is needed.[1] This is a simple miracle that makes your effective ground length only a few inches!

"There is absolutely no excuse for the cruddy signals on HF . . . if you're not going for the solution, you're part of the problem."

A coax ground is made using *good* quality (95% shield braid) coax such as Columbia 1107 or 1108 RG-8/X or Mini-8 with a stranded center conductor. The center conductor is used as the ground wire, connected to the *rf generating unit* and the outside ground system. It's bypassed at each end with a .01-uF, 1-kV disc capacitor to the shield braid (see Fig. 1). Don't tie all of your station's components together with zip cord or aluminum wire. Let the coax shield handle the dc grounding between units as it is seldom over a foot or so long. Otherwise, you set up ground rf loops that defeat everything you've done.

Microphones seem to be universally designed for use in high school auditoriums, with no rf suppression whatsoever. This is simple, so simple that there is absolutely no excuse for rf feedback in this area. All that is usually necessary is to install a .01-uF disc capacitor across the microphone cartridge (do it quickly because it can't take much heat!) and add a 1-mH choke in series with the audio high lead. This may be done at the mike or on the inside of the mike jack of the transmitter, which is more convenient when using several microphones. If using a power mike, ferrite beads on the transistor base leads and a pi filter using two .005-uF capacitors with a 1-mH choke are called for (Fig. 2).

In summation, there is absolutely no excuse for the cruddy signals on HF, and if you're not going for the solution, you're certainly part of the problem. These steps will also knock an RFI problem in the ditch. ■

Reference

1. "The Capacitive Coaxial Ground Wire," *73*, May, 1980, p. 82.

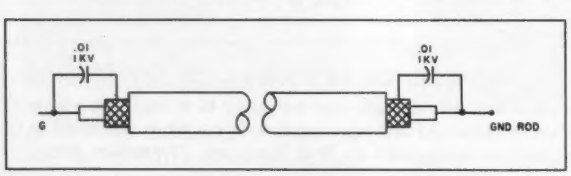

Fig. 1. The coax ground couldn't be simpler.

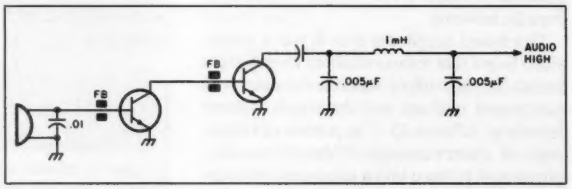

Fig. 2. A little rf suppression will dramatically improve your transmitted audio.

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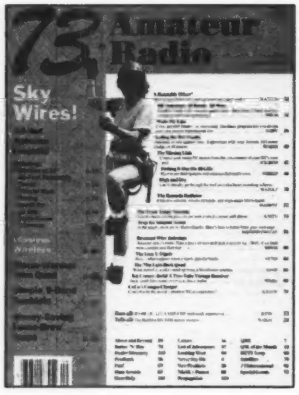

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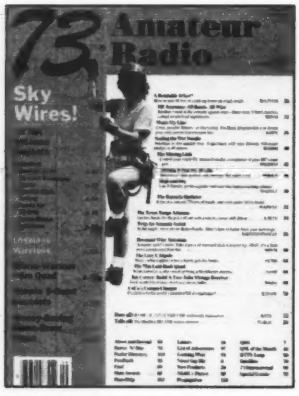

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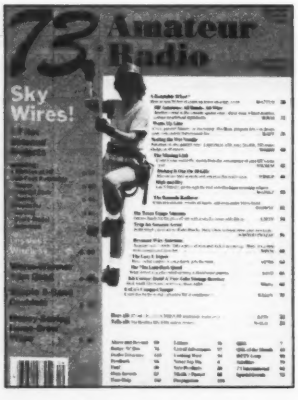

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Commodore's RTTY Riot

If you can get the C-64 away from the kids, try this simple method of computerizing your TTY operation.

Number 4 on your Feedback card

The Baudot Model 14, 15, and 19 Teletype® machines have to some extent fallen from favor. Even the wondrous Model 33 (ASCII) is now selling at dumping prices at flea markets. It's no secret that flea-market prices tend to be a bellwether of change. In this case, they simply reflect the impact of personal computers on the ham shack. But the rush to get rid of the old reliable printer workhorses may be a bit premature: They continue to be great hard-copy machines for RTTY, and interfacing to the C-64 through the current loop can be done for just a few dollars and very little effort.

This home-brew C-64 interface/KG3V-software combination will go receive or transmit at 45 bps or 110 bps with the Hal ST-6—and probably with any terminal unit that is presently connected (or connectable) to the 60-mA loop of a Teletype® machine such as a Model 14, 15, or 19. (300 bps and 1,200 bps with home-brew KG3V modem—see July, 1981, *Ham Radio*.)

There are a number of ways to work out a practical hookup between the older RTTY tuning units, printers, and the PCs most often found in ham shacks. Except for its cost effectiveness, this project doesn't break any new ground. And as for the computer part, the Commodore 64 appears to be as popular a choice as any for the ham shack. It also happens to have a user port that is a very friendly place to gain access to the operating system.

We have one Model 15 working perfectly with this interface and a ten-year-old home-brew demodulator built with polar relays and another with a Hal ST-6. With regard to the latter, as the loop current is supplied by the tuning unit, the TTY printer can be eliminated if desired. When this is done, a current-limiting device (100 mA maximum) must be installed in the loop to protect the interface. (Note: Some ST-6s may require a small modification to enable 75- to 110-baud operation. The details of this mod are available from the Hal corporation.)

Fig. 1 shows a functional block diagram of the various units required to complete the project. If an existing station is to be converted in this manner, nothing need be disturbed except for breaking the loop current line to make a series connection with the interface (two wires). The C-64 is not disturbed in any way at all. Simply plug in the interface at the user port and load the "RTTY" program.

One advantage of using this system is that when you are not in the shack, the computer can be switched off without breaking the loop. Therefore, autostart traffic can still be copied with the page printer.

The software required to turn your C-64 into a RTTY machine is the brainchild of Thomas B. Zelwanger KG3V. The program *and* documentation (at latest revision) can

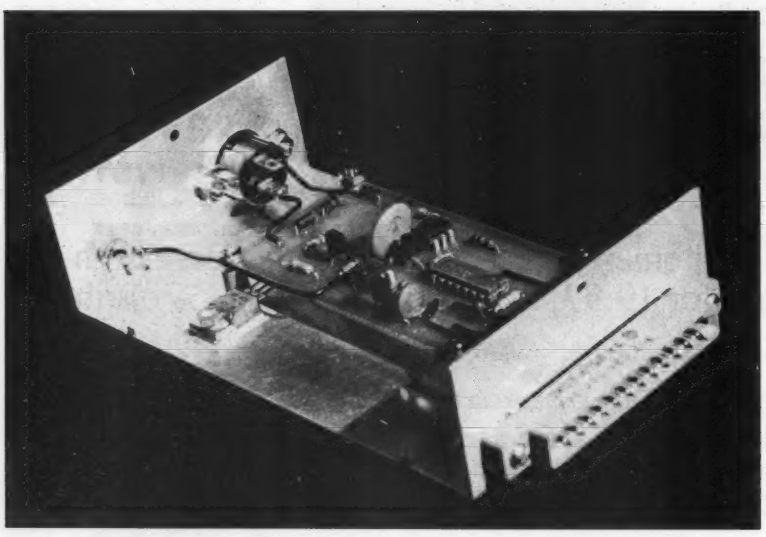


Photo A. The fully assembled interface with top cover removed.

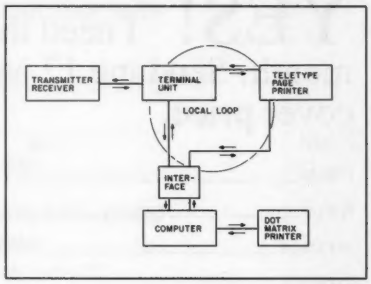


Fig. 1. Block diagram, RTTY local-loop configuration.

be obtained from KG3V (PO Box 62, State College PA 16804). Send Tom a blank tape or disk along with $2 for postage and packing. The purpose of his generosity is to encourage greater activity on RTTY, and while you won't find all the bells and whistles of commercial software on the KG3V program, it is nevertheless very effective.

Construction of the interface is quite conventional. There is lots of room on the board for the parts. Use standard printed-circuit cautions in the parts assembly. Radio Shack part numbers are given in the parts list when possible.

Fig. 2 shows the schematic diagram, Fig. 3 shows the circuit-board layout, and Fig. 4 shows the parts placement in graphic scale.

Q1 (RCA SK-3220/198) is packaged complete with mounting hardware. Substitutes for this part may be packaged individually. This transistor is mounted to the circuit board and to the case for a heat sink. To ensure a precision fit between Q1 and the circuit board and the case, use the spacer length called for and assemble the transistor as shown in Fig. 4. The case requires the drilling of nine holes and a cutout for the edge connector, as shown in Fig. 5.

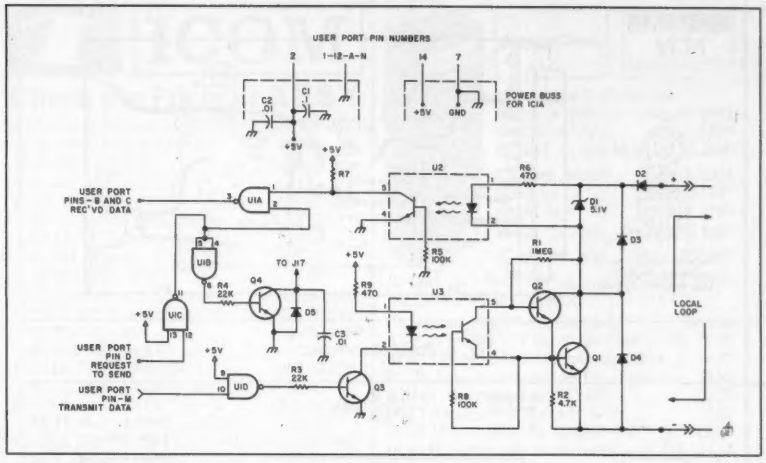


Fig. 2. RTTY/C-64 interface schematic.

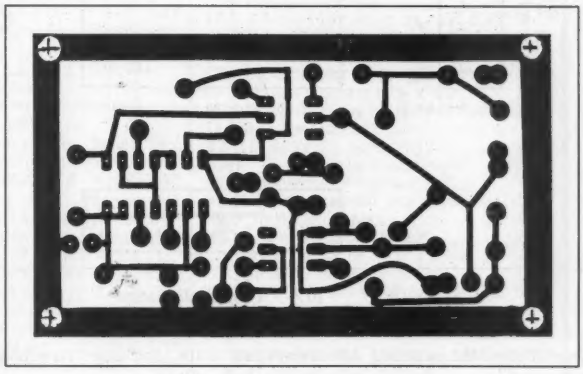


Fig. 3. Interface circuit board.

Circuit Description

As is well known to RTTY aficionados, there are few electrical circuits in use by hams as simple as the common local loop. Its only purpose is to interconnect the peripherals commonly associated with the RTTY mode. This loop, or common line, is a universal message cable for the serial data coming from or sent by these peripherals. However, all RTTY gear (pre-solid-state) incorporates high-voltage circuits and lots of rugged components. Computers are not quite that simple. The object of the project interface is to make the C-64 compatible with the local loop.

The basic function of the interface is to orchestrate the transfer of data between the high voltage levels of the ST-6 (et al) and the TTL voltage levels of the computer.

With the software driver loaded and running, the user port is configured as an RS-232C data port. Add the interface, and the receive serial-data stream enters the computer at pins B and C. On transmit, a request-to-send signal is sent by the computer to pin D, and the transmit serial-data stream leaves from pin M. The request-to-send signal can be used to control the transceiver. More on that later.

Only the pins in Table 1 are used for this project; the remainder can be disregarded.

The project interface is seen by the terminal unit as just another peripheral. Connection to the loop is made by breaking the circuit and splicing in the interface with a serial connection through PL-1. Polarity must be observed. Turn off power to the computer before plugging in the interface, and switch off the tuning unit before working on the external loop circuit.

The emitter of Q1, emulating a normally closed switch, is enabled open when the base current of driver transistor Q2 is shorted by the output transistor in optoisolator U3.

R1 supplies a small current to Q2, which provides a bias to hold Q1 closed during mark pulses. This normally closed switching default is an important feature. The normally closed Q1 switch preserves local-loop continuity and allows data flow through the terminal unit and printer, even when the computer is switched off or disconnected from the project interface.

Data generated by the computer has a logic orientation as is required for RTTY encoding. Mark is a 1 (or 5 volts). Space is a 0 (zero volts). The outbound data stream of ones and zeros is present only on transmit, appears at pin 10 of IC1, and is routed to output pin M.

U1 has four NAND gates. Section U1D is set up to invert the computer output so that mark = 0 and space = 1. The output of this gate (pin 8) drives Q3 through a current-limiting resistor (R3) at the base. Q3 conducts on space and switches on the photodiode portion of U3.

The switched-on photodiode triggers its optically coupled transistor into conduction, which results in a drop in the bias current of Q2, thus turning it off. The normally closed switch then opens. This breaks the local loop for the duration of the space pulse.

Data from the loop is received through optoisolator U2 where the photodiode and series resistor R6 shunts zener diode D1, which is connected in series with Q1. R6 limits photodiode current to 8 mA during mark, or 60-mA loop current.

In the absence of loop current, defined by the presence of space pulses, the U2's photodiode turns off and the phototransistor stops conducting.

When the photodiode switches off, pull-up resistor R7 develops a 5-volt level at pin 1 of U1. Gate U1A inverts the 5-volt level to a logic-0 voltage level. This signal appears at pins B and C on the edge connector.

D3 and D4 avert voltage-spike damage to components on the loop side of the interface. D2 protects the interface from accidentally reversed loop polarity.

The C-64 RS-232C port has full-duplex capability, but it cannot be paired with current-loop RTTY machines because the local loop is not a full-duplex circuit. A design feature of the project interface eliminates interference to received data caused by echoing.

When the control operator elects to transmit, the interface comes to attention with two responses. First, pin D on the edge connector gets a request to send in the form of a logic 1. This signal also appears on pin 12 of U1 (gate C), which inverts the signal. The output of gate C appears at pin 2 of U1 (gate A), which cuts off the output of this gate.

This latter feature prevents transmitted data from filling the C-64 receive buffer. Without it, the receive buffer will fill from the previous transmission and dump to the

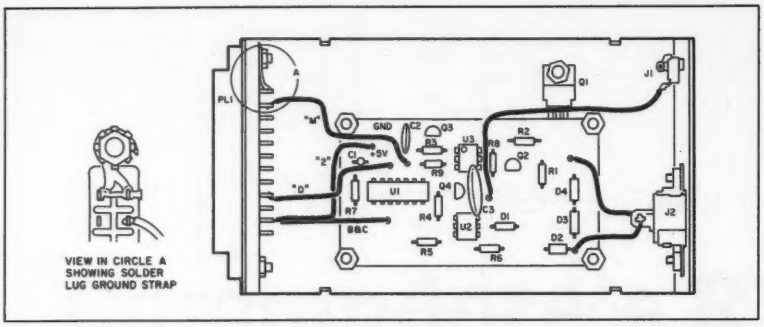


Fig. 4. Parts placement.

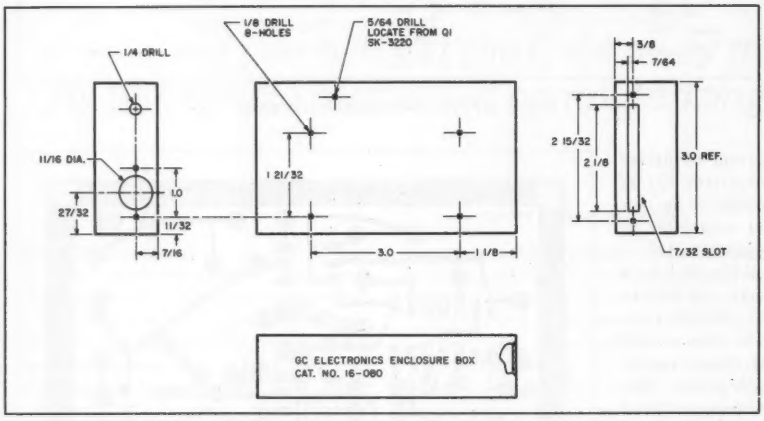


Fig. 5. Case modification.

screen before the incoming data stream can be reviewed.

An additional design feature utilizes an option available on most transceivers and transmitters for using the PTT line. With this feature, the transceiver can be controlled from the computer keyboard. This is done by transistor Q4, which is biased by U1B through current-limiting resistor R4. U1B inverts the logic 0 sent by U1C and turns on Q4. CR4 protects Q4 from the reverse EMF generated by relay coils in some radio equipment.

Q4 is heavy enough to switch on the PTT current in most rigs, but a PTT line with an open voltage greater than 20 volts will rate something heavier, such as the MPS-A42.

Putting It Together

First, use Fig. 3 and direct etching transfers (or your preferred method) to prepare the circuit board. Next, prepare the case by drilling the mounting holes (see below for details of Q1 mounting) and cutting clearance for the edge connector.

The etched and drilled board can be stuffed with abandon, except for the mounting of Q1. Dress Q1's leads as shown in Fig. 4 and proceed as follows: With the exception of Q1 and miscellaneous wires, all parts should first be assembled to the PC board. Special care must be taken with Q1 at this point to ensure a stress-free assembly of the PC board, transistor, and case. Assemble Q1 and solder in place.

The PC board—with Q1 soldered in position—is mounted on the lower half of the box. Use spacers on the 4-40 screws as specified. The fasteners can be finger-tightened to stabilize the board temporarily.

Bend and adjust the leads of Q1 so that the mounting surface is in firm contact with the box and mark the location of the mounting hole. Remove the board and set it aside.

Drill a 9/64 hole for Q1 as marked. This completes machining of the case.

Complete the board assembly by soldering hook-up wires (3" lengths) to the circuit-board eyelets for connections to chassis and edge connector.

Before reinstalling the finished board on the box half, apply a light coating of silicone heat-sink compound to the mica insulator, the back of the transistor case, and the area around the mounting hole on the box cover. Next, with the insulator located between Q1 and the chassis, press Q1 firmly into place and, using 4-40 hardware plus the supplied plastic washer under the nut, fasten lightly. Q1 must be attached to its mounting surface with the insulating hardware packaged with SK-3220.

It is important that Q1 be mounted with care. Mechanically, a good fit is required, and electrically, the mounting tab on Q1 will be at collector potential and therefore must be insulated from the chassis ground.

Pin	Function
A, N	Ground
B	Received data
C	Receive data flag
D	Request to send
M	Transmit data
2	+5 volts
1, 12	Ground

Table 1.

Complete the assembly by installing and wiring the edge connector and the loop connector receptacle. Take care when wiring the edge connector. Make a positive identification of each pin. Your computer's data-port chip will be directly connected to the project interface.

The interface is now ready for testing. *Incorrect wiring could damage your computer*; just follow the hook-up diagram and all will be well.

Testing the Interface

Warning! Open-loop supply voltages may exceed 150 volts. Before working with loop connections, be certain that related equipment is switched off.

Step 1 is a preliminary checkout and should be done before connection with the computer or the loop circuit is begun. First, check resistance from the +5 eyelet on the board to ground. This check should show an open circuit. A low reading that does not vary means that there is probably a construction or wiring error present.

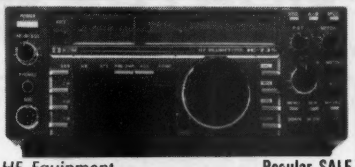
Next, make a resistance check from ground to each loop connection and from ground to the mounting tab of Q1. All readings should indicate an open circuit. If the preliminary check is satisfactory, connect the interface to the loop.

The success of the next test will rely upon the presence of loop current. A stabilized 60 mA is optimum. If the loop current drops out, recheck the polarity by reversing the loop connections to the interface. If the loop current does not hold after checking polarity, the problem can most likely be traced to an error in component placement. If the loop current holds, it will be safe to assume that the loop-switching circuit is working.

Now plug in the interface at the user port and *then* switch on the power. Load and run the RTTY program.

A note about software. This project was designed with the KG3V package in mind. It is probable that software other than this will do as well or better. The KG3V program, however, is available free of charge and is in the public domain. The remainder of these test procedures will assume the KG3V software.

Select mode 0 and hit function key F1. Using a VOM, logic probe, or scope, check the potential on IC1, pin 12. This should be close to 5 volts. Check the potential on IC1,



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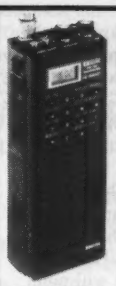

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pin 10. The voltage reading on this pin should drop briefly to zero when the space bar is depressed. This drop in voltage certifies the presence of space intervals.

Check the voltage on R9 at the optoisolator connection (IC3). The results should be the same as those seen on IC1, pin 12. Return the meter probe to IC1, pin 12. The voltage should drop to near zero when function key F1 is depressed. Go to pin 11. This reading should also be close to 5 volts. Failure to get the voltage readings as specified will point first to a solder bridge on the PC board and then to a defective IC.

If everything checks out, it may be assumed that the interface is in good working order. Fire up the RTTY station and tune in a RTTY signal.

In mode 0 (60 wpm) receive, you should "see" any incoming print that is on the local loop. If there is a problem, check the voltage drop across D1. This should read 5.1 volts. The voltage drop across R6 should be close to 3.7 volts. Check across pins 1 and 2 (pin 1 positive, pin 2 negative) for a drop of 1.2 volts. A zero reading here indicates that IC2 is defective.

Before replacing IC2, recheck the values of R6, D1, and the local loop current, which should be 60 mA when closed. If all is well, hit the F1 function key once more and enter some spaces with the space bar. A printer on the loop (turn it on) should show spaces.

Troubleshooting problems with character transmission are best started at the optoisolator side of R9. Look for 4.7 volts on space. The collector of Q3 should go to near zero during the space interval. The voltage drop across pins 1 and 2 of IC3 will be difficult to see without a scope, but it should be close to 1.2 volts.

If the problem persists, check the voltage across pins 4 and 5 of IC3. With no output from the computer, it should be close to 0.7 volts. A reading of zero indicates that IC3 or Q2 is defective. Keep in mind that the voltages around Q1 and Q2 are at local-loop potential during space intervals. If at this point trouble still persists, check the orientation of D3 and D4.

Q1 can be checked by measuring the voltage drop across the emitter and base. A correctly functioning device will develop close to 0.7 volts when the 60-mA holding current is present; the drop across the collecter and emitter will be very close to zero. During open loop periods, this latter voltage will approximate that of the open loop.

One last comment: The project interface will safely handle a loop-current level as high as 100 mA, but it should be avoided. ■

Parts List

Integrated Circuits			
U1	7400 quad 2-input NAND gate TTL	Jameco	$ .29
U2, 3	4N25 optoisolator	Jameco	1.38
Transistors			
Q1	SK-3220 high-voltage power output NPN	RCA	2.75
Q2	MPS-A42 high-voltage driver	Radio Shack	.69
Q3, 4	2N2222 general-purpose NPN	Jameco	.68
Diodes/Rectifiers			
D1	IN4733 5.1-V, 1-Watt zener	Jameco	.22
D2–5	IN4006 HV 1 Amp	Jameco	.88
Capacitors			
C1	.1-uF, 10-V tantalum	Radio Shack	.50
C2	.01-uF, 25-V disc	Radio Shack	.20
C3	.01-uF, 100-V disc	Radio Shack	.20
Resistors (1/4 Watt, 5%)			
R1	1 megohm	Radio Shack	.10
R2	4.7k	Radio Shack	.10
R3, 4	22k	Radio Shack	.20
R5, 8	100k	Radio Shack	.20
R6, 9	470 Ohms	Radio Shack	.20
R7	4.7k	Radio Shack	.10
Hardware			
J1	Mini-jack	Radio Shack 274-251	.40
J2	Multi-pin connector (Jones type) two-pin male*	Radio Shack 274-201	
	Two-pin female	Radio Shack 274-202	1.79
	6″ x 6″ blank copper circuit board	Radio Shack	2.19
	Direct-etching dry transfers	Radio Shack 276-1577	2.59
	GC Electronics Chassis Box #16-080 (5-1/8 x 3 x 1-1/4)	Shand Electronics	4.07
	12/24 PC edge connector with solder eye terminal	Jameco 12/24SE	3.95
	Seven 3″ lengths of #22 solid copper hook-up wire 100′ spool	Radio Shack 278-1295	2.19
	#4 solder lug		.10
	60/40 rosin core solder PC type BPO dispenser model DS-1	Fordham Radio	.79

*Required for loop only.

Addresses: Digi-Key, Highway 32 South, Thief River Falls MN 56701; Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002; Fordham Radio, 260 Motor Parkway, Hauppauge NY 11788; Shand Electronics Inc., 2401 Dort Highway, Flint MI 48503.

About Fasteners: The small quantity of fastening hardware required to hold this project together can no doubt be found in the nooks and crannies of most ham-radio workshops, and the cost will be nil. However, for those who are starting from scratch, the following items are available at hobby shops and hardware stores in small-quantity blister packs. Radio Shack catalog numbers are given here for these items. There will be plenty left for the next project.

64-3011 (14 pkg. #4-40 x 1/2 round-head machine screws)	.99
64-3018 (30 pkg. #4-40 machine hex nuts)	.99
Two 64-3024 (24 pkg. assorted spacers)	1.98
64-3022 (20 pkg. #4-40 flat washers)	.99
Nine #4-40 x 1/2 round-head machine screws	.45
Nine #4-40 machine nuts	.45
Two #4 flat washers	.10
Four #4 x 1/4 metal spacers	.40

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4-BAND SLOPER - 160, 80, 40, 30, or 20M		60 ft. long	$ 48 ppd
3- " " - 160, 80, 40M		60 ft. "	$ 43 "
2- " " - 80, 40M		40 ft. "	$ 35 "
3- " NO-TRAP DIPOLE - 160, 80, 40M		113 ft. long	$ 71 "
2- " " " " - 80, 40M		85 ft. "	$ 55 "
9-BAND SPACE-SAVER DIPOLE - 160 thru 10M*		41ft. long	$ 85 ppd

* Requires wide-range tuner (80, 40, 20, 15M without tuner)

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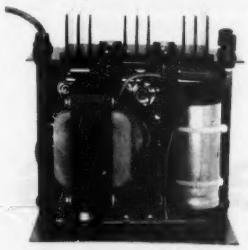

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RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

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MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W X D	Shipping Wt (lbs)
RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

• Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

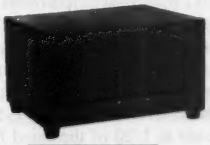
VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES



MODEL RS-12S

• Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

Hugh Wells W6WTU
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Transistors On The Bias

Remember the last time you designed a transistor amplifier? The pile of parts that didn't work? Wells ends all that with this Basic amplifier-designer program.

Number 5 on your Feedback card

If you are an electronics tinkerer and a part-time computer hacker, you need this computer program. It was developed to manipulate the myriad of formulas surrounding one of electronics' most common building-block circuits, the class-A common emitter amplifier (shown in Fig. 1). Because of the flexibility of the circuit, there are infinite combinations of components that will work perfectly well. But what happens to the input impedance if you change the value of R2? Or output impedance when R3 is changed? The value of a computer becomes quickly apparent when you want to play what-if games with the circuit.

To use the computer program, five pieces of information must be entered: transistor beta (h_{fe}), maximum power dissipation, the resistance of R2, the power-supply voltage, and the lowest operating frequency. The most obscure of the five is power dissipation. This may be based upon the maximum device dissipation (spec value) or the maximum that is desired in a specific circuit application. Selection is the user's choice. If you are not familiar with how dissipation values affect the circuit, then working with V_{ce} vs. I_c characteristic curves (Fig. 2) for a typical junction transistor will provide the necessary data.

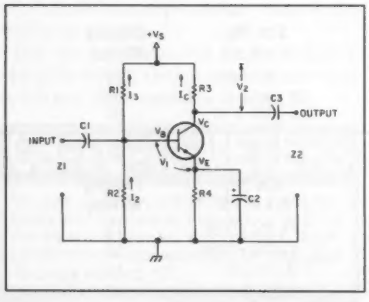


Fig. 1. Class-A common emitter amplifier.

The dotted line represents a constant power dissipation (Pd) and is determined by the product of V_{ce} and I_c at each intersecting point along the curve. All transistors have a maximum dissipation value, but it is not necessarily desirable to operate them at the maximum value in every circuit application. In fact, device reliability (and longevity) can be improved by operating to the left side of the maximum power dissipation curve established by the manufacturer.

Circuit Variables

The selection of maximum power dissipation and the power-supply voltage (V_s) will determine the dc loadline for the circuit. The loadline is like a railroad track in that it establishes an operating path for the transistor within the circuit. All transistor circuit voltages and currents intersect along the loadline, establishing the circuit operating parameters. As an example, a specific collector current and voltage drop between the collector and emitter of the transistor may be found at the loadline intersection with a specific base current value.

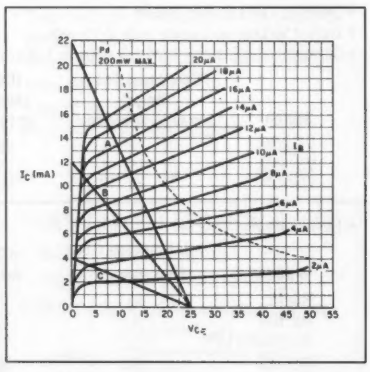


Fig. 2. V_{ce} vs. I_c characteristic curves.

For class-A amplifiers, the base current value is selected to provide a quiescent operating point (QOP) such that the collector voltage value will be one half of the power-supply voltage. Placing QOP at the point equal to one half V_s provides a nearly equal signal swing for both positive and negative signal excursions before peak amplitude distortion occurs. QOP is the zero-signal resting point on the loadline. Resistor R1 determines the base current value, which is used to establish the QOP position on the loadline.

The position of the loadline at location A, B, or C is selected by the amount of power dissipation chosen. Selecting one value over another is a matter of choice based upon various alternatives. In general, the lower the loadline is, the higher the input and output impedances will be. Obviously, though, circuit values are in parallel with the impedance of the respective circuit and will restrict the impedance range variation obtained.

Resistor R2 has the most direct effect on the input impedance, while R3 has the most effect on the output impedance. Signal linearity and gain also are affected by the loadline position. Lowering the loadline will tend to raise the transfer gain. However, signal linearity may be degraded. Therefore, how is the position of the loadline to be selected?

The usual way is to use the cut-and-try technique to work out the circuit values to achieve the desired results. Another technique is to examine the transistor curves and associated formulas to find the desirable circuit values for a given transistor and circuit application. With your help in selecting input data, the computer will work with the formulas, making circuit analysis very easy.

Before starting the analysis, choose a power dissipation value between 1/4 and 1/2 of the transistor's rated dissipation. Some circuits operate at 1/20 of the rated Pd, but in any case, the Pd is chosen to satisfy the cir-

B	Transistor beta
C	Temporary capacitor variable
C1	Input capacitor value
C2	Emitter bypass capacitor value
C3	Output capacitor value
F	Frequency
G	Gain
I	Collector current print variable
IB	Base current
IC	Collector current
I2	R2 current
I3	R1 current
P	Selector variable
P1	Power dissipation
R1	Base-VS resistor
R2	Base-ground resistor
R3	Collector-VS resistor
R4	Emitter-ground resistor
T	Temporary variable
VB	Base-ground voltage
C	Collector-ground voltage
VE	Emitter-ground voltage
VS	Power-supply voltage
V1 + V2	Emitter-base voltage
X	Reactance variable
Z1	Input impedance
Z2	Output impedance

Table 1. Program variables.

```
10 REM DEVELOPED BY HUGH WELLS - 3/86
20 PRINT CHR$(125):REM CLEAR SCREEN/HOME
30 PRINT :PRINT "  TRANSISTOR DESIGN PROGRAM FOR"
40 PRINT "  CLASS-A SMALL SIGNAL AMPLIFIERS."
50 PRINT :PRINT "ENTER THE DATA AS REQUESTED."
60 PRINT :PRINT "TYPICAL BETA (HFE) VALUE ";:INPUT B
70 PRINT "MAX PWR DISSIPATION IN MW ";:INPUT P1:P1=P1*10^-3
80 PRINT "ENTER 1=SILICON  2=GERMANIUM ";:INPUT T
90 PRINT "DESIRED SOURCE VOLTAGE ";:INPUT VS
100 VE=0.1*VS:REM CALCULATES EMITTER VOLTAGE
110 IF T=1 THEN V1=0.7:REM SILICON
120 IF T=2 THEN V1=0.3:REM GERMANIUM
130 V2=VS-VE:REM CALCULATES VOLTAGE ACROSS R3
140 PRINT "ENTER LOWEST OPERATING FREQ (20-300)"
150 PRINT "FOR 3 DB ROLL-OFF ";:INPUT F
160 R3=((0.5*V2)^2)/P1:REM CALCULATES COLLECTOR LOAD
170 PRINT "SELECT BASE-GND RESISTOR VALUE"
180 PRINT "(1K-100K) ";:INPUT R2
190 IC=(0.5*V2)/R3:REM CALCULATES COLLECTOR CURRENT
200 R4=VE/IC:REM CALCULATES EMITTER RESISTOR
210 R4=INT(R4*10+0.5)/10
220 IB=IC/B:REM CALCULATES BASE CURRENT
230 VB=V1+VE:REM CALCULATES VOLTAGE AT BASE
240 VC=VS-(R3*IC):REM CALCULATES COLLECTOR VOLTAGE
250 I2=VB/R2:REM CALCULATES R2 CURRENT
260 I3=I2+IB:REM CALCULATES R1 CURRENT
270 R1=(VS-VB)/I3:REM CALCULATES UPPER BASE RESISTOR
280 Z1=(R2*(B*R4))/(R2+(B*R4)):Z1=INT(Z1):REM CALCULATES INPUT Z
290 Z2=R3/4:Z2=INT(Z2):REM CALCULATES OUTPUT Z
300 X=Z1/4:GOSUB 370
310 C1=C:C1=INT(C1*100)/100:REM INPUT CAPACITOR VALUE
320 X=R4/5:GOSUB 370
330 C2=C:C2=INT(C2*100)/100:REM EMITTER BYPASS CAP VALUE
340 X=Z2/4:GOSUB 370
350 C3=C:C3=INT(C3*100)/100:REM OUTPUT CAPACITOR VALUE
360 GOTO 380
370 C=(0.159*10^6)/(F*X):RETURN
380 G=0.6*B:REM APPROXIMATE CIRCUIT GAIN
390 PRINT CHR$(125):REM CLEAR SCREEN/HOME
400 PRINT "TYPICAL VALUES FOR CLASS-A OPERATION."
410 PRINT :PRINT "TRANSISTOR TYPE IS ";
420 IF T=1 THEN PRINT "SILICON."
430 IF T=2 THEN PRINT "GERMANIUM."
440 PRINT "TRANSISTOR BETA (HFE) = ";B
450 PRINT "PWR SUPPLY (VS) = ";VS;" VOLTS"
460 I=INT(IC*100000+0.5)/100
470 PRINT "COLLECTOR CURRENT (IC) = ";I;" MA"
480 PRINT "MAX PWR DISSIPATED = ";P1;" WATTS"
490 R1=INT(R1)
500 PRINT "R1 (BASE-VS) = ";R1;" OHMS"
510 PRINT "R2 (BASE-GND) = ";R2;" OHMS"
520 R3=INT(R3*10+0.5)/10
530 PRINT "R3 (COL-VS) = ";R3;" OHMS"
540 PRINT "R4 (EMITTER-GND) =";R4;" OHMS"
550 PRINT "LOWEST OPER. FREQ. = ";F;" HZ"
560 PRINT "C1 (INPUT CAP) = ";C1;" UF"
570 PRINT "C2 (EMITTER BYPASS) = ";C2;" UF"
580 PRINT "C3 (OUTPUT CAP) = ";C3;" UF"
590 PRINT "APPROX INPUT Z = ";Z1;" OHMS"
600 PRINT "APPROX OUTPUT Z = ";Z2;" OHMS"
610 PRINT "APPROX CIRCUIT GAIN = ";G
620 VB=INT(VB*100+0.5)/100
630 PRINT "VOLTAGE AT BASE = ";VB;" VOLTS"
640 VC=INT(VC*100+0.5)/100
650 PRINT "VOLTAGE AT COLL = ";VC;" VOLTS"
660 VE=INT(VE*100+0.5)/100
670 PRINT "VOLTAGE AT EMIT = ";VE;" VOLTS"
680 PRINT "TO RUN AGAIN, ENTER 1=Y 2=N ";:INPUT P
690 IF P<>2 THEN RUN
700 PRINT CHR$(125):PRINT :PRINT "          COME AGAIN SOMETIME"
710 PRINT :PRINT :PRINT "          BYE BYE!!!":PRINT :PRINT :PRINT
```

Program listing.

cuit application. Typical transistors—such as 2N2222, 2N4401, 2N2907, and 2N4403—have a maximum power dissipation rating of 310 mW in free air. When properly heat-sinked, the 2N2222 will dissipate up to 1.8 Watts reliably. However, in most applications, the usual "free-air" dissipation is considerably less than 310 mW, allowing the circuit impedance to rise along with a reduced power-supply current drain. An advantage of the computer program is that a variety of circuit conditions may be examined quickly in order to find component values to meet the application requirements.

A value for R2 may be selected in many ways. However, the proper way would be to select it to be approximately twice the value of the desired input impedance. There is no real detriment to selecting an R2 value that is too high except that bias stability may be affected. If R2 is too low, the resulting low-input impedance (Z1) requires more drive power from the preceding circuit. However, the actual ratio of R2 current to base current is not critical as long as bias stability exists. By rule of thumb, current through R2 should be at least 10 times higher than I_B.

The Program

To keep the operator-entered data to a minimum, a few assumptions have been made. The first was to establish an emitter voltage at 10% of the power-supply voltage. Doing so allows the emitter resistor value to rise sufficiently for stable biasing and prevents thermal runaway. Thermal runaway may occur if the emitter-to-ground voltage value is allowed to approach the base-emitter voltage value (0.7 volts for silicon devices).

The second program assumption is that the application transfer gain will be approximately 60% of the device's beta value. The actual transfer gain can be found only by working with actual device curves and/or the h_{ie} parameter.

A third assumption involves the lowest frequency of operation. It is assumed that the reactance of each capacitor in the circuit will be nearly equal to its relative circuit impedance. Capacitor C1 would then have the same reactance as the input impedance at the lowest operating frequency, causing half of the input signal voltage to be dropped across the capacitor. The other half would be dropped across the amplifier's input. Capacitor value determination using this technique provides a calculated rolloff of about 3 dB (half power) or less at the lowest operating frequency.

The program was developed using generalized Basic to allow easy entry into the greatest number of types of computers. In addition, program variables are listed in Table 1, and remark statements are used abundantly within the program to help the user follow through the program steps. ■

Irving M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

No Free Lunches

The grail of perpetual motion has eluded scientists for thousands of years—are we on the brink of discovery?

Number 6 on your Feedback card

Beyond their practical involvement in technology, hams have very naturally maintained interest in the tenets of science and physics—in particular, those matters relating to the uses of energy. Without the various exploitations and transformations of energy, electricity and electronics would have remained but laboratory curiosities.

It is no wonder, then, that the patent office has long been plagued by alleged inventions of "free lunches"—the on-the-spot creation of energy and its corollary, perpetual motion. Surprisingly, however, this is not the exclusive realm of the ignorant, the irrational, or the scientific illiterate. When one probes beneath the superficialities of this subject, both quacks and eminent physicists are found in the mix. Indeed, there appears to be a gray area between the possible and the impossible wherein "practical" perpetual motion merits consideration even if the academic purist's version is unattainable.

For example, the nuclear derivation of energy from a pound of uranium so greatly exceeds the energy available from the combustion of a pound of coal that it is almost suggestive of magic. Compared to the more familiar energy processes, the nuclear utility station can be viewed as a practical approach to energy creation. Similarly, solar energy conversion systems operate for practical purposes, as if energy were being created.

We know, of course, that the pound of uranium—as well as the sun—must ultimately run down as a direct consequence of releasing its energy. So, even though "true" perpetual motion, or nondepleting energy, must remain a fantasy, untapped abundances in nature lure the adventurous in spirit, and it is not improbable that useful and practical compromises might result from seekers of the free lunch. Such things as fuel cells and vehicles operated from the kinetic energy stored in rapidly rotating flywheels come to mind.

Although the patent office automatically rejects perpetual-motion machines, it would accord an inventor an open-minded evaluation if only he would bring along a *demonstrable model*. A common excuse tendered by the alleged inventor of a perpetual-motion machine is that his prototype is not yet ready for demonstration because certain refinements must be made to eliminate unanticipated friction (see Fig. 1 for an example). How sad and how true! Let's look further into this matter and see what various free-lunch proponents and critics have said and done.

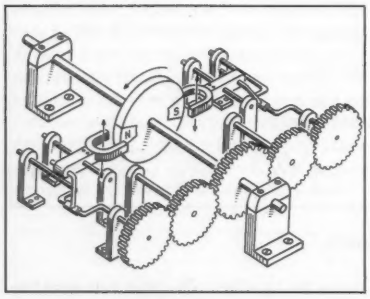


Fig. 1. Hitherto, attempts to secure continuous rotation in motors using only magnets have not been successful. An obstacle has been a condition of latchup wherein the arrangement quickly comes to a standstill after very limited motion. In this invention, a mechanical-feedback system is claimed to prevent such stoppage. The inventor promises to demonstrate such a self-running motor as soon as certain frictional losses can be reduced to a satisfactory level.

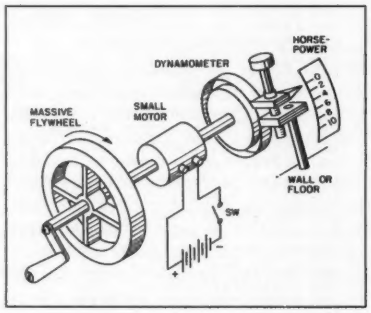


Fig. 2. The "Garabed," an alleged free-energy system. The claim and interpretation were predicated on the following demonstration: 1) The flywheel is manually set in rotation. 2) The switch, SW, is closed, energizing a small motor of 1/25 horsepower or so. 3) Because the small motor supplies frictional losses, the flywheel turns at a constant speed. 4) The dynamometer is adjusted so that the brake lining grips the rotating drum; it is observed that a maximum output indication of about 10 horsepower occurs briefly before the system comes to a halt. 5) Interpretation is made that 1/25 horsepower was multiplied to 10 horsepower as a manifestation of the "free energy" provided by the system. But, momentary high-power does not mean that the output energy exceeds the total energy imparted to the flywheel.

Gems of Wisdom From the Experts

A classical defense of the pursuit of perpetual motion and on-the-spot creation of energy stems from the obvious fact that there was once a first-time demonstration of the various inventions we now take for granted. Therefore, declare those who thus remind us of this, there will someday be a first-time demonstration of a perpetual-motion machine! And, though we may refute such statements with logical arguments, our position is likely to be weakened by reminders of past opinions voiced by experts who should have known better.

What makes such reminders particularly embarrassing is that these experts seem to have widely missed the mark in their own field of expertise. When the weatherman or the stockbroker calls the shots incorrectly, we tend to be tolerant and forgiving, but not so when the scientist gives us wrong directions. Yet, it is entirely possible for an expert in any field to cough up erroneous predictions. After all, we forget that whatever notable achievements underlie his fame and recognition, they were reached only after he discarded many mistaken judgments; we shouldn't be harsh with him for advancing just another mistaken judgment.

When Lord Kelvin was president of the Royal Society, he adamantly let it be known that "heavier-than-air flying machines are impossible." And a notable mathematician of the era ground out some elegant equations showing that such an accomplishment was indeed in violation of natural law. It was later found that his analysis also indicated that the bumblebee was incapable of flight. Fortunately, neither the bee nor the Wright brothers were versed in such high mathematics. And then Nobel prize winner Robert Millikan put to rest the hopes of forward-looking physicists by stating: "There is no likelihood

that man will ever tap the power of the atom." Topping both, the 1899 director of the U.S. patent office declared: "Everything that can be invented has been invented."

It obviously behooves us to be tough-minded in demanding proof of a claim that may strike us as far-fetched; at the same time, true open-mindedness is a requisite. Otherwise, it might be to our everlasting embarrassment that we failed to recognize an Edison or an Einstein because of our self-righteous notion of the possible and impossible. Even the charlatans and the self-deluded deserve due consideration; the practice will serve us in good stead when the real McCoy comes along.

The Garabed: Delusion Despite Sincerity

Perpetrators of fraud that many alleged inventors of perpetual motion are, some deserve credit as accomplished magicians; as with the stage magician who saws the pretty girl in half, it just ain't so! Often, there is a concealed colleague-in-crime turning a crank in another room, or there are hidden wires supplying the electrical energy, which seemingly originates from nothing.

Such was not the case with a notable proponent of free energy, Garabed Giragossian. This sincere, but scientifically deluded inventor claimed in 1917 that he had discovered a means of providing humanity with inexhaustible energy instantly available for any purpose. Because he mistrusted the patent office, he requested special protection from Congress instead of filing a patent. With the aid of influential supporters of his claim, the requested protection was granted in 1918 in the form of a public resolution. The resolution, however, was conditional on the premise that the free-energy device had to pass the scrutiny of an appointed commission of engineers and scientists. This it failed to do.

It is particularly interesting to examine the nature of Giragossian's machine, for his mistaken interpretations are commonly made in patent applications, and are continually encountered in basic science classrooms. The Giragossian machine was essentially a massive flywheel coupled to a tiny electric motor (see Fig. 2). The demonstration commenced by having an assistant turn a crank until the flywheel was turning at a respectable rate. Then the motor was turned on. Instead of gradually losing speed and ultimately stopping, the flywheel now proceeded to run continuously at a constant speed. This, of course, was because the tiny electric motor provided just the required power to overcome the frictional and windage losses, which otherwise would have slowly eroded the spinning motion of the flywheel.

So far, so good—no claims were made on this aspect of the machine, which incidentally was called the "Garabed." It was in the next step of the demonstration that this sincere, but miscalculating inventor purported to see evidence of free energy. With the flywheel spinning at a constant rate, he dumped its kinetic energy into a brake-type dynamometer, which briefly indicated about 10 horsepower. The flywheel, of course, quickly

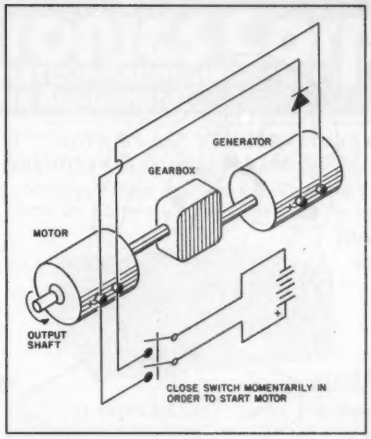


Fig. 3. A representative arrangement of motor-generator perpetual-motion systems. Hopefully, once the motor is operating, its continued operation will be sustained from the output of the generator. The switch, dc source, and the rectifier comprise the startup circuit. Hopefully, too, the gear box ascertains that the motor will be able to drive the generator fast enough to develop high output from the generator.

came to a standstill, having dissipated its energy into the frictional brake of the dynamometer. Giragossian's interpretation was that the Garabed had multiplied the output of the fractional horsepower motor to 10 horsepower.

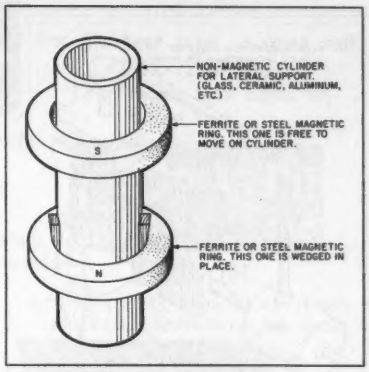
High Power Does Not Always Imply High Energy

Where did the fervent and sincere Giragossian err? It was simply his inability to distinguish between energy and power. Most certainly, he did succeed in stepping up available power, which is the *rate of using energy*. We can do the same thing in charging a large capacitor from a low-power source of direct current. If we allow sufficient time for the capacitor to charge fully, a very powerful, but short-duration discharge can be produced by shorting its terminals.

Such a miniature lightning stroke does indeed develop more heat, light, sound, and air ionization (that is, more *power*) than might be had by shorting the terminals of the dc supply. Unfortunately, however, the charged capacitor is an inferior supplier of *energy* compared to the dc supply. As a matter of fact, it always turns out that about one-half of the energy supplied during charging is dissipated in whatever resistance may be involved in the charging circuit.

The manifestation of high power by itself does not suffice to identify it as a source of high energy; what may be lacking is the capability of delivering high power over an *extended period of time*. Both the capacitor and Giragossan's flywheel fail in this respect because they quickly lose their power-generating feature.

Another version of Giragossian's approach to the free lunch involves an electric motor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FERRITE OR STEEL MAGNETIC RING. THIS ONE IS WEDGED IN PLACE.
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Fig. 4. A "food-for-thought" experiment. No external energy supply is needed for the levitated ring. The upper ring remains levitated indefinitely; neither ring looses magnetic strength. The constant repulsive force from the north poles of the magnetic rings overcomes gravity. If this experiment were simulated by electromagnets, it is obvious that electrical energy would have to be supplied (but only to overcome Ohmic resistance).

and generator system in which the motor is supposed to drive the generator, which in turn powers the motor, which in turn drives the generator, etc. Not only is it hoped that the system will sustain its own operation, but it is supposed to also deliver useful work to the external environment.

Sometimes elaborate gear trains are imposed between motor and generator so that the increased speed of the generator will suffice to overcome frictional losses. But, no matter how such inventors fool around, they ultimately find they cannot fool nature and her immutable laws. In simple language, the energy output of a machine is always less than the energy input.

It is truly remarkable how much energy pursuers of the free lunch will expend to defeat nature's energy law. Before the electrical age, the popular approach to perpetual motion was some manner of unbalanced wheel; in the process of turning, a wheel would somehow experience continual disturbances in weight acting around its rim so that a turning torque was continually applied (see Fig. 3). No contraption of this kind ever remained in sustained motion. Indeed, the more mechanical sophistications applied, the more inherent friction was incurred and the quicker the wheel ground to its inevitable halt!

Mad Inventors or Optimists?

It is always profitable to try to see the other fellow's point of view. What motivates the seeker of the free lunch? Aside from the hoaxer, it turns out that this field may indeed be worthy of study, effort, and experimentation.

Consider, for example, some means of liberating the energy of atomic nuclei that does not also liberate a host of radioactive isotopes, as happens in nuclear fision. Such an accomplishment would make available

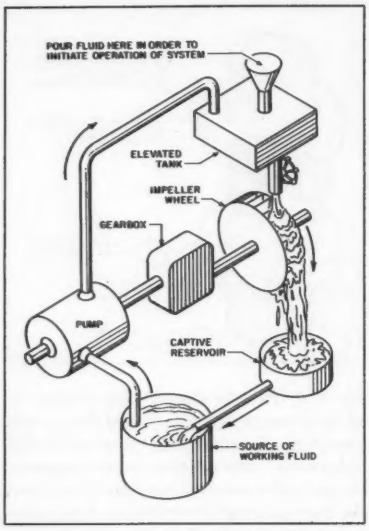

Fig. 5. Basic theme of many hydraulic perpetual-motion systems. Operation of a closed-cycle system is supposed to be self-sustained after initial startup. The gear box represents inventor's attempt to obtain more vigorous pumping action, thereby "fooling" the system to overcome its losses.

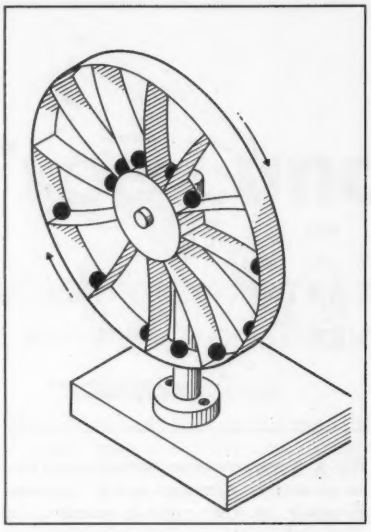

Fig. 6. Perpetual-motion wheel for providing free energy from gravity. This is a typical application of the unbalanced or over-balanced wheel. The radius arm of the steel balls is supposed to shift in such a manner as to keep the wheel turning.

tremendous amounts of usable energy in a relatively clean process.

This is exactly what is being sought in the fusion-technique experiments presently being carried out. If they are successful, it will be possible to extract much of the world's energy from sea water. From a practical standpoint, such an accomplishment will certainly be an *almost*-free lunch. Who knows, perhaps some obscure inventor may come up with an alternate, but simpler means of bringing about fusion than the elaborate systems presently being investigated by teams of eminent scientists?

It is understandable that would-be inventors of nearly free-lunch machines might be misled by statements of definitions commonly found in technological texts. For example, the formula Efficiency = Output Power/(Input Power + Losses) is usually OK in the context in which it is used. It might, however, be better to replace the word power with "energy," in which case there could be no misinterpretation. The possible trouble with the power equation is that it does not involve *time*, as does energy. This allows one to deal with a hypothetical system or machine in which a large peak, or short-duration power, is available at the output, thereby creating the illusion that the operation exceeds 100%.

The Lure of Magnets

Magnets and magnetism have long exerted an irresistible mystique for the pursuers of inexhaustible energy or motion. Indeed, several simple manifestations of magnetism are not easily explained to the satisfaction of those who purport to see possibilities beyond already attained achievements. An electric generator delivers electrical energy as a consequence of the mechanical energy used in turning it. However, the intermediary function of magnetism is bothersome to some; particularly intriguing is the fact that a permanent magnet in a simple dc generator does not "run down." To those who think in this manner, the electrical energy seemingly is provided by the magnetic field, and the mechanical energy input to the generator just happens to be one way of extracting this energy via our crude technology.

Another aspect of magnetic behavior is the observation that a steel ball or roller will be drawn to a magnet, often with great force at the time of actual impact. Why, then, not arrange a circular pattern of magnets and rotating members to produce continuous rotation—a magnetic motor, so to speak? This turns out to be a real brain teaser, for no matter how the scheme is implemented, the rotational motion is short-lived. Obviously, something must be done at the instant of lockup in order to enable further rotation. But what?

Surprisingly, the publishers of *Science & Mechanics*, generally an excellent treatise on technology, featured on the cover of their Spring 1980 edition an artist's rendition of a remarkable home power-plant utilizing a 15-horsepower "magnetic motor" to drive a 5,000-Watt generator. The inventor actually received a patent for the underlying principle. Yet, such an scheme seems to violate fundamental precepts of physics, thermodynamics, and energy conservation. Were such a scheme and such a machine actually feasible, all aspects of modern civilization would undergo an instantaneous quantum jump in global living standards, the like of which has not yet been experienced or even imagined.

Finally, those who try to coax magic out of magnets are intrigued by the phenomenon of levitation. Put two magnetized rings of ferromagnetic material on a supportive rod of nonmagnetic material and, providing the fields are in opposition, one ring will remain indefinitely levitated above the other (see Fig. 4).

The classical explanation is that this is no big deal—no motion is involved, so no work is being done. However, the fact that the force of gravity is overcome by the interaction of the two fields points to a possible free lunch for those so inclined to see things that way. Here, the question as to why the magnetism is not depleted by the continuous "effort" may not engender a soul-satisfying answer.

Closed-Cycle Fluid Systems

The observation that falling water can pack a wallop harks back to an era when artificially kindled fire and the wheel were high technology. Not long after Archimedes invented a means of pumping water from a lower to a higher elevation, it was only natural for him to rig up a system that was supposed to operate in a self-sustaining manner. His scheme comprised the pump mechanically coupled to a water wheel. The pump was supposed to transport water to a higher level, whereupon it was allowed to fall on the water wheel, which then kept the pump going, as well as the entire system—it was hoped (see Fig. 5). But there was no cry of "Eureka!" for the contraption utterly frustrated this otherwise great intellect.

To give credit where due, Archimedes did devise a clever pump for his day. This consisted of a pipe in the shape of a helix. Dipping one end of the helix into a vessel of water and turning it would pump water to a higher level. Today, would-be inventors continue to repeat Archimedes' failed experiment using more sophisticated pumps, modern water wheels, gear boxes, and other components calculated to help fool nature. None, however, has yet been heard to exclaim, "Eureka!"

Unbalanced Wheels

If you spin the front wheel of an upside-down bicycle, the long duration of rotation can easily exceed expectation. What we have here is a finely balanced wheel pivoted on inordinately low friction bearings. Observations of this kind have long inspired seekers of perpetual motion to try to add some gimmick to such a wheel in order to enable it to turn indefinitely. The popular approach is to induce unbalance in such a way as to continually apply turning torque to the spokes or rim of such a wheel (see Fig. 6 for one example).

Much ingenuity has been displayed in such endeavors; yet each and every perpetual-motion wheel thus far built has disappointingly failed to make its inventor rich and famous. Indeed, a new law of nature has been suggested by such endeavors: The more elaborate the scheme for automatically unbalancing the tuning wheel, the more quickly it grinds to its inevitable halt!

Although planets spin for eons and electrons apparently spin forever, wheels all too quickly respond to the dissipative effect of

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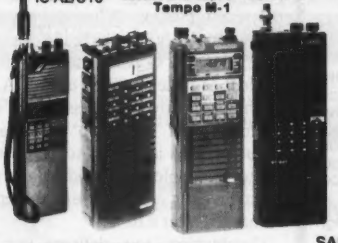

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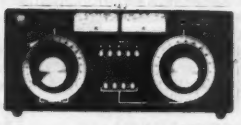

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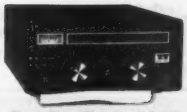

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friction. And sadly, even if all frictional forces could be eliminated, the spinning wheels could only give back the energy imparted to it when it was set in motion.

New Ideas and Oft Repeated Pitfalls

It is not enough to identify a source of energy and attempt to make it do useful work. Energy confers no benefit to us unless it is *available*. A warm mass of metal does indeed contain heat energy. But, such heat energy will not of its own accord flow to a hotter mass of metal. It is much like expecting a ball to roll uphill. If, however, the inventor arranges his apparatus so that there can be a flow of heat energy from a hot to a cold body, he is on the right track and may well come up with a new and useful machine or energy-conservation technique.

A stumbling block often overlooked by the enthusiastic would-be inventor is the nature of chemical reactions. All chemical reactions tend toward a stage of equilibrium wherein the reaction stops. When the equilibrium is attained quickly, you have the ingredients for an explosion; slower reactions enable such devices as batteries to be useful. A corollary of the equilibrium process is that the initial chemicals get "used up" or change their status in such a way as to be ultimately no longer available for providing energy. Thus, electric cells must be either replaced or recharged after a time.

Combustion, too, delivers just so much energy from the chemical fuels. Along with perpetual-motion machines, patents are often sought for alleged 400-mile-per-gallon carburetors. Of course, the bottom line to such inventions is that the major oil companies buy them up and keep them off the market! Although improved carburetors and fuel injectors constantly squeeze more efficiency from automobiles as the years go by, you can bet your boots that outlandish claims can be taken with a grain of salt.

Speaking of chemical reactions and automobiles, a continually "reinvented" panacea for the expense of fueling the automobile involves a hydrogen-operated engine in which the hydrogen is indirectly created by the engine itself. The basic idea is to have the engine drive a generator, which provides electric power to free hydrogen from water by electrolysis. So, you collect the hydrogen and burn it in the engine, which hopefully provides both motive power and the power to turn the generator.

Electrical and chemical systems are often manipulated by would-be inventors who would have the everyday horse sense not to pursue an analogous goal via a mechanical system. Thus, wheels with hinged weights to keep them forever in motion may loom up as obviously ridiculous. But in electrical and chemical systems, the link between cause and hoped-for effect is invisible or less obvious; a would-be inventor may become hoodwinked by the apparent sophistication of his violation of nature's laws. Not even the microprocessor or computer can be successfully deployed to fool nature. So, if the system in its most primitive form cannnot lift itself by its bootstraps, there is nothing to be gained from a program instructing it to do so.

Some Open-Minded Conclusions

If the would-be inventor's quest is not perpetual motion or free energy, but more bang for the buck, it is less easy to try to accuse him of chasing a pipe dream. For then, he can justifiably maintain that he is working in the realm of the possible and the practical. Consider such processes and techniques as geothermal sources of electric power, fuel-cell energy systems, and solar and wind electrical sources. These are all capable of providing "cheap lunches" in the quest for abundantly available energy. Moreover, they are not blue-sky projects; successful applications already exist and are giving good account of themselves.

In both technology and science, there are activities that resemble ordinary notions of perpetual motion or free energy, but upon closer scrutiny are found to either abide by natural laws of energy conservation or are more hypothesis than fact. For example, a resonant circuit cooled to near-zero temperature will oscillate indefinitely, or almost so.

But can energy be extracted from such a "tank"? It is indeed easy enough to tap such an energy source, but in so doing, the available energy will be depleted. This happens every time instrumentation is applied to ascertain that oscillation still exists. Therefore, such a cryrogenic resonant circuit, far from being a free-lunch energy source, is nothing more than a sophisticated storage system—like a battery, charged capacitor, or tank of water, it does not automatically replenish what it gives up.

In science, there is the hypothesis that the near vacuum of intergalactic space is not as benign as once supposed. Rather, energy can apparently arise from such apparent "nothingness." The reasoning underlying such "far-out" theorizing is more mathematical and esoteric than practical. The harnessing of such a cosmological source of energy probably had best be left to the Buck Rogers and Superman scenarios of space-age science, unless you are prepared to *demonstrate* your working model to the skeptics in the patent office.

Science, itself, is in a dilemma regarding the absolute integrity of the conservation of energy in the universe at large. Right now, effort is being expended trying to learn whether the proton of atoms has an infinite life span, or whether it, too, ultimately decays. In the meantime, there is little communication to the non-scientist bold enough to ask such questions as why the elementary particles of physics, such as the electron, spin without letup. Instead of holding their breath until really satisfying explanations of such enigmas are forthcoming, inspired inventors will continue their quest for unconventional energy sources. And, the smart ones will diplomatically refrain from presenting "free-energy" systems or "perpetual-motion" machines to the patent office—less friction will be provoked through the use of other words and phrases. ■

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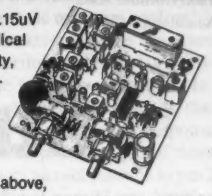

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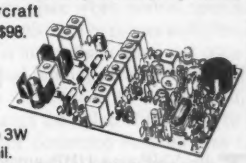

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Antenna Input Range	Receiver Output
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50–52	28–30
50–54	144–148
144–146	28–30
145–147	28–30
144–144.4	27–27.4
146–148	28–30
220–222	28–30
220–224	144–148
222–226	144–148
220–224	50–54
222–224	28–30

UHF MODELS	
Kit with Case	$59
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Wired	$75

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435–437	28–30
432–436	144–148
432–436	50–54
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Exciter Input Range	Antenna Output
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28–29	145–148
28–30	50–52
27–27.4	144–144.4
28–30	220–222*
50–54	220–224
144–146	50–52
144–148	28–30

For UHF, Model XV4 Kit $79 Wired $139

28–30	432–434
28–30	435–437
61.25	439.25
144–148	432–436*

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Hamtronics Breaks the Price Barrier!

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MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-160	150-172 MHz	$49
LNG-220	210-230 MHz	$49
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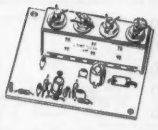
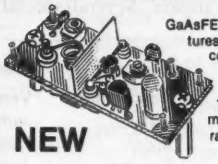


MODEL	TUNING RANGE	PRICE
HRA–144	143–150 MHz	$49
HRA–(*)	150–174 MHz	$49
HRA–220	213–233 MHz	$49
HRA–432	420–450 MHz	$64
HRA–(*)	450–470 MHz	$64

**Specify Center frequency desired*

MINIATURE PREAMPS



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Models available to tune the following bands: 25–35, 35–55, 55–90, 90–120, 120–150, 150–200, 200–270, and 400–500 MHz.

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GaAsFET Preamp with features like LNG. Automatically switches out of line during transmit. Use with base or mobile transceivers up to 25W. Tower mtg hdwr incl.

MODEL	TUNES RANGE	KIT	WIRED
LNS–144	120–175 MHz	$59	$79
LNS–220	200–240 MHz	$59	$79
LNS–432	400–500 MHz	$59	$79

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Subaudible Snooping

Track down subaudible access tones with KE6VK's low-frequency counter.

Number 7 on your Feedback card

The VHF and UHF amateur bands are filling up with repeaters, and many repeater owners are finding it necessary to require the use of subaudible tone encoders to access their repeaters. The design presented here is a counter which, when connected to a receiver, will display the frequency of the subaudible tone used by the transmitting station. Several special circuits have been designed into the counter to provide proper filtering of the desired tone and to allow a frequency resolution of 0.1 Hz in a counting interval of only 0.2 seconds.

The typical frequency range of subaudible tones is 67.0 Hz to 250.0 Hz, with an FM deviation of 0.5 kHz or less. This low value of deviation means that unwanted signals with higher deviations, such as speech, must be rejected. Also, the point at which the receiver audio is obtained must be prior to the low-frequency filters in the audio amplifiers to avoid unwanted rolloff.

Parts List

Value	Description	Vendor	P/N	Qty.	Price
0.01 uF	Mylar	Jameco	MY.01/100	2	$ .54
0.001	Mylar	Jameco	MY.001/100	2	.24
4–34 pF	Ceramic	Jameco	TC 4–34	1	.75
1 uF	Film	Jameco	P4537	4	2.64
22 uF, 16 V	Elect.	Digi-Key	P6024	1	.14
100 uF, 16 V	Elect.	Jameco	R100/16	2	.42
U1–U4	TIL311	Jameco		4	43.80
U7–U10	74C160	Jameco		4	4.76
U11	74LS74	Jameco		1	.39
U17	TL084	KCS		1	1.40
U13	CD4060	Jameco		1	.89
U14, U15	CD4518	Jameco		2	1.98
U12	CD4011	Jameco		1	.29
U16	CD4046	Jameco		1	.89
U18	MF10CN	Digi-Key		1	3.75
U6	7808	Jameco		1	.79
U5	7805	Jameco		1	.79
3.2768 MHz	Crystal	Digi-Key		1	1.62
4.7 Meg, 1/4 Watt		Jameco		1	.06
1.0k, 1/4 Watt		Jameco		4	.24
1.8k, 1/4 Watt		Jameco		3	.18
68k, 1/4 Watt		Jameco		1	.06
270k, 1/4 Watt		Jameco		1	.06
390k, 1/4 Watt		Jameco		1	.06
100k, 1/4 Watt		Jameco		4	.24
1.5k, 1/4 Watt		Jameco		2	.12
12k, 1/4 Watt		Jameco		2	.12
1.2k, 1/4 Watt		Jameco		3	.18
2.2 Meg, 1/4 Watt		Jameco		1	.06
47k, 1/4 Watt		Jameco		1	.06
180k, 1/4 Watt		Jameco		2	.12
1.8k, 1/4 Watt		Jameco		1	.06
82k, 1/4 Watt		Jameco		1	.06
6.8k, 1/4 Watt		Jameco		1	.06
100 Ohm, 1/4 Watt		Jameco		1	.06
390 Ohm, 1/4 Watt		Jameco		1	.06
					$67.94

Sources of supply: KCS Electronics, 1043 North Stadem Drive, Tempe AZ 85281; Digi-Key Corp., PO Box 677, Thief River Falls MN 56701; and Jameco Electronics,1355 Shoreway Road, Belmont CA 94002.

Circuit Design

A block diagram of the counter is shown in Fig. 1. The input frequency is passed through a low-pass filter, a tunable bandpass filter, and then into a phase-locked loop consisting of a phase detector, voltage-controlled oscillator (vco), and frequency divider. The vco generates a frequency 100 times the input frequency, and this signal is used to tune the bandpass filter. The 100f frequency is then divided by two and used as the input to the counter. The counter time base allows the counter to count for 0.2 seconds, latches the result into the display, and resets the counter for the next counting interval. Counting a 50f frequency for 0.2 seconds results in a displayed frequency of 10f and, by moving the decimal point one digit to the left, we can display the frequency f with a resolution of 0.1 Hz.

Fig. 2 is the detailed circuit diagram. The audio enters at the input to U17A, which presents a high input impedance to the receiver and a low output impedance to drive the low-pass filter. U17B and U17C form a low-pass filter with a cutoff frequency of 300 Hz to provide rejection to speech. The bandpass filter, U18, is placed between the two low-pass sections and tunes itself to 1/100th of the frequency of the vco, automatically centering the filter at the desired frequency. The final amplifier section, U17D, is connected as a comparator.

U16 contains both the vco and the phase detector, and the frequency dividers are in U15. Up to this point in the circuit, the ICs all run from a regulated 8 volts from U6. Since the rest of the circuit operates at 5 volts, a level shifter using 1k and 1.8k resistors is necessary for proper interface. The time-base generator, U13, uses a 3.2768-MHz crystal and divides it down to 200 Hz. Another divider, U14, divides the 200 Hz down by 40, resulting in a timing period of 0.2 seconds. The function of U11A and U12 is to cause the display to update after 0.2 seconds, reset the counters (U7–U10), and reset the time-base divider chain (U13, U14).

The main counter chain is U7–U10, and it connects directly to the display ICs, U1–U4. The displays also contain integral latches and decoders as well as provisions for blanking and lighting decimal points. The left-hand decimal point on U4 is wired to be continuously on. The rest of the decimal points are wired to the output of U11B, which acts like a lock detector. When the phase-locked loop is out of lock, U11B will cause the decimal points to turn on or flash.

Operation

The Q of the bandpass filter (47) and the phase-locked-loop filter time constants were determined experimentally by trying to minimize lockup time and maximize rejection of voice modulation. The bandpass filter Q should be high to provide filtering, but low enough to allow some signal to the phase-locked loop when it is not locked. The present design locks up in about one second if the level of the subaudible tone is 0.5-kHz deviation. Do not be surprised if the display reads 120.0 Hz on stations with poorly filtered power supplies.

Interfacing and Adjustment

The time base may be measured in one of several ways. If a counter is available that will measure period, it can be connected to U14, pin 13 and the variable capacitor adjusted for .200000 seconds. Pin 12 of U11B should be grounded during this measurement. Another alignment method is to measure the frequency of the crystal at U12A, pin 10 and to adjust the frequency to 3.276800 MHz.

The power requirements are 12–14 volts at about 360 mA. Both voltage regulators should be mounted to a heat sink of four to six square inches to provide adequate cooling.

The audio connection to the receiver should be at the discriminator output or possibly just before the volume-control pot. Inspect the circuit carefully for circuits that would roll off the low-frequency response and connect the audio pickup ahead of these filters. Next, connect an oscilloscope to pin 2 of U18 and note if any limiting takes place when normal speech is received. The proper audio level is that which causes just occasional limiting on audio peaks. If the gain needs to be adjusted, change the value of the 100k resistor connected between pins 6 and 7 of U17A. More gain requires a higher value; a lower value will reduce the gain.

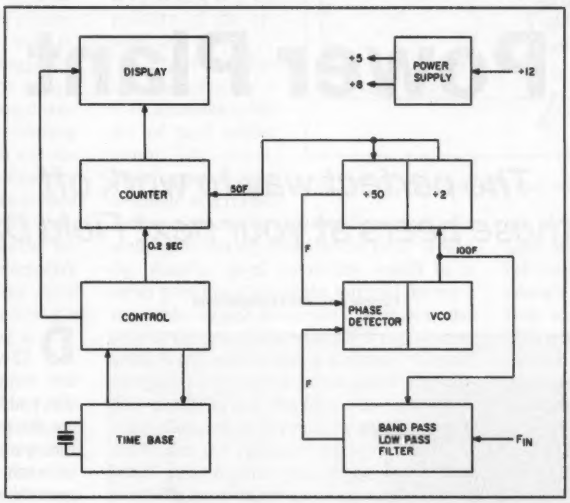

Fig. 1. Block diagram.

Conclusion

This subaudible tone counter will allow you to make on-the-air measurements of the tone frequency of a transmitting station. If the signal you are receiving is the output of a repeater, bear in mind that most repeaters will roll off the low frequencies and not retransmit them. The best results will be obtained if the station can be received directly. ■

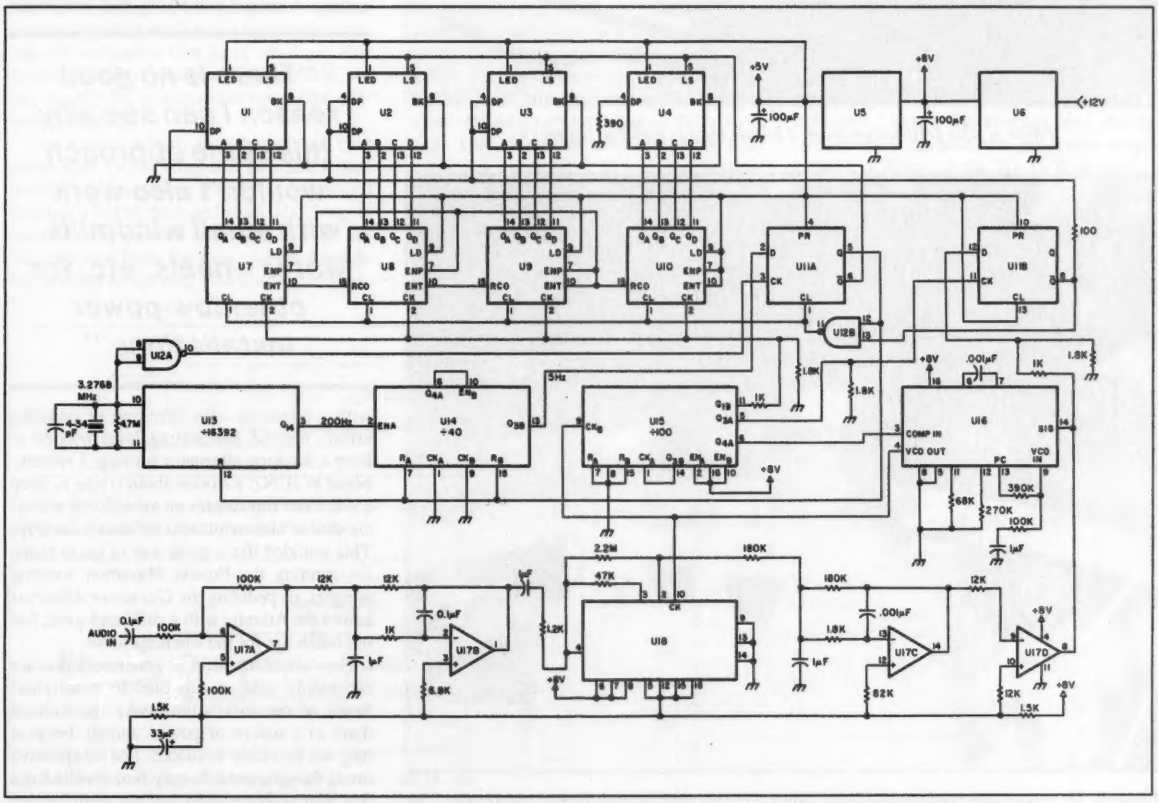

Fig. 2. Circuit diagram.

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A Pedal-Pushing Power Plant

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Number 8 on your Feedback card

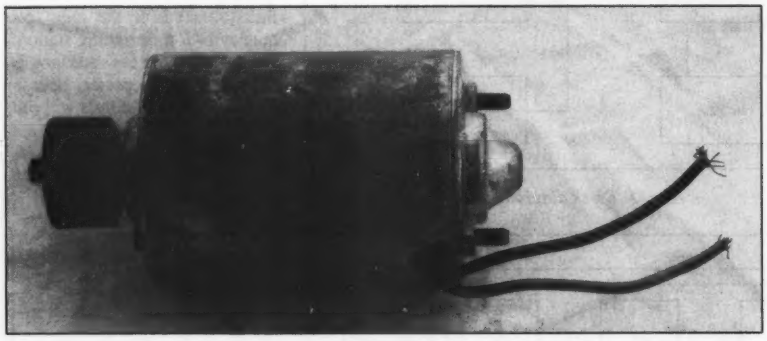

Photo A. The 1/10-horsepower, 12-V-dc bicycle pedal-assist motor.

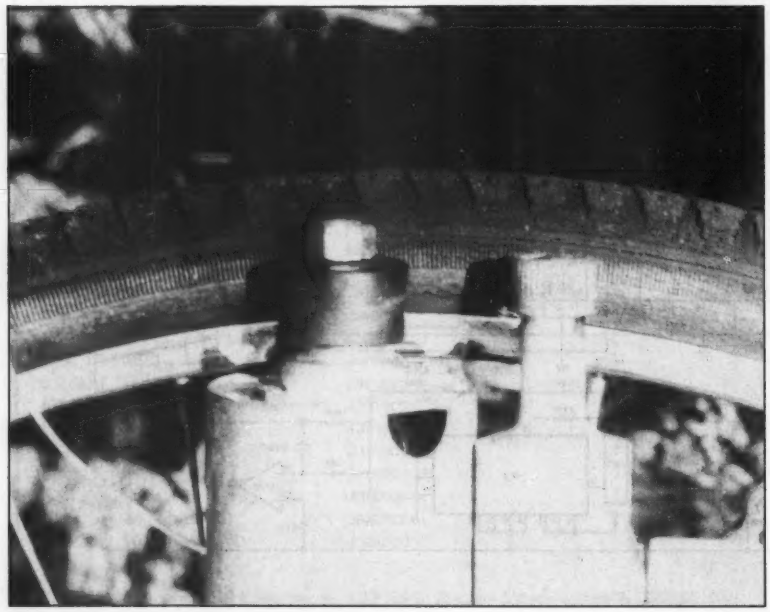

Photo B. The motor with the home-brew friction roller mounted against the bicycle tire rim. The smaller roller is the regular bicycle headlight generator.

Do you need an inexpensive source of 12-volt auxiliary power for emergency use, camping out, Field Day, and the like? I did, and I wanted to use my bicycle to generate the power. Regular automotive alternators were too heavy, cumbersome, and hard to crank using a bike. What I needed was something that would provide a steady 10 or 15 Watts for operating QRP or that could charge up a small lawn-tractor or motorcycle battery. I needed something that would run

"There is no good reason I can see why this same approach wouldn't also work with small windmills, water wheels, etc. for other low-power installations."

with a relatively easy cranking or pedaling effort, not the gut-busting level needed to keep a 50-Amp alternator turning. I remembered W2DNZ's stories about trying to keep a 100-Watt transmitter on the air with a bicycle-driven alternator with no battery backup. This sounded like a great way to get in shape for running the Boston Marathon wearing weights, or pedaling the *Gossamer Albatross* across the Atlantic with a stiff head wind, but not much fun for the weekend ham!

How about the little ac generators that are commonly sold to run bicycle headlights? Some of the survivalist books recommend them as a source of power, mostly because they are so widely available. The inexpensive ones, though, provide only 6 to 8 volts for a few Watts—better than nothing at all but not very useful. Using a voltage doubler or even

tripler right off the ac generator might deliver enough voltage to charge up a stack of NiCd penlight cells to power an HT or small QRP rig, but at only a few mils of current it would take an awful lot of pedaling.

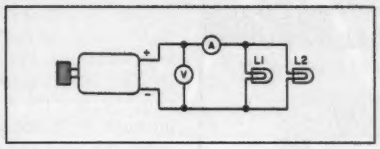

Fig. 1. Circuit used in the first test run.

What I needed was a compromise, something with more power than a bicycle generator, but not as big as a heavy-duty auto or truck alternator. Two possibilities suggested themselves: either a small alternator from a lawn tractor, snowmobile, or outboard motor, or a permanent-magnet dc motor running backwards as a generator. The small alternators seemed almost ideal, but availability and price were a problem. Also, they tended to have unusual gear or belt-driven hardware, and they required a battery backup for the field current. I looked at automotive windshield washer motors, but they were cumbersome because of their right-angle worm-gear drives.

The Motor

After much searching, I settled on a 1/10-horsepower, 12-V-dc, permanent-magnet motor manufactured by Bosch. It is a pedal-assist motor for bicycles and electric mopeds, though it also has wide applications in things like wheelchairs and hobby robots. This particular one was purchased for five dollars at a hamfest flea market, but the same or similar motors regularly are listed in the surplus catalogs of companies like Etco, Meshna, Fair Radio, Herbach & Rademan, and several others, usually for prices in the ten-dollar-and-under category.

The motor is built in a cylindrical case about four inches long and two and a half inches in diameter. Power is provided through a 5/16″ threaded shaft 3/4″ long at one end. The positive and negative leads are both isolated from the case and are brought out through an opening on the side. The rotation of the armature is reversible with the polarity of the applied dc.

A friction roller was made from a 1-1/4″ diameter cylinder of hard rubber about 3/4″ thick. This happened to be available as a rubber foot on a piece of surplus medical electronic equipment, but any small rubber roller would do. Another good possibility would be a small grinding wheel of the sort sold for electric drills, though this might tend to wear the bicycle tire out after a while. If this generator setup is to be used with a stationary bicycle (as opposed to one that can be ridden) then the rear wheel tire and tube should be removed, a small diameter pulley mounted on the motor shaft, and the armature belt-driven off the wheel rim. Another possibility would be a small-diameter chain sprocket driving a 2:1 or 3:1 surplus step-up reduction gear.

With the friction drive arrangement I used, the gears on the bike were set at their highest speed; the rear wheel was turning approximately four revolutions for every turn of the pedals. Adding in the diameter ratio between the 26″ rear tire and the 1-1/4″ friction wheel, the total turn ratio was on the order of 80:1. This meant that when the pedals were turned at a steady 40 or 50 rpm, the armature was spinning in the vicinity of 3,500 to 4,000 rpm, which is about the same speed that the armature runs when it is lightly loaded as a 12-V-dc motor.

The setup for the first test run is shown in Fig. 1. Automotive taillight bulbs were used as a load, with the filaments hooked up in parallel. An ammeter was placed in series with the load, and a voltmeter across it. The mechanical resistance of the generator was strong enough so that output varied considerably from one part of the pedal stroke to another. This is no problem with the bicycle actually in motion, as the inertia of the bike and rider is adequate to smooth things out. On a test stand, though, it is hard to get a steady enough output to read the meters (see Fig. 2).

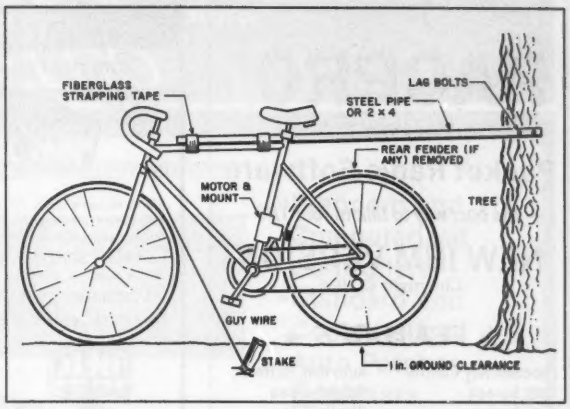

Fig. 2. The test stand. You may want to find a jockey to do the pedaling.

The circuit in Fig. 3 was then tried. A couple of 2,200-uF capacitors were put in parallel with the armature and the load. The capacitance acted as an electrical flywheel and also raised the average output voltage somewhat. By really cranking hard on the pedals, a peak output of about 3.5 to 3.8 Amps at just a tad under 12 volts was the best that could be sustained. For most low-power ham operations, 30 or 40 Watts at 12 volts is adequate, and if the average load can be scaled back to hold the generator output around 3 Amps, at the 30–35-Watt level, a comfortable rate of pedaling can be sustained—about the same effort as riding on level pavement.

However, 11.9 to 12.1 volts is just a little too low for charging up a 12-volt standby battery. A nominal 12-volt lead-acid battery needs around 13 volts or better for recharge, even more if a blocking diode is used. At-

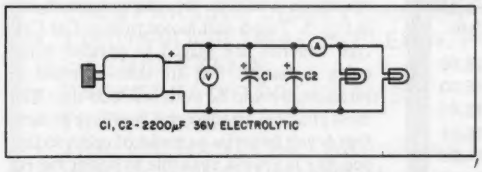

Fig. 3. Modified test circuit, with two 2,200-uF capacitors in parallel with the armature and the load.

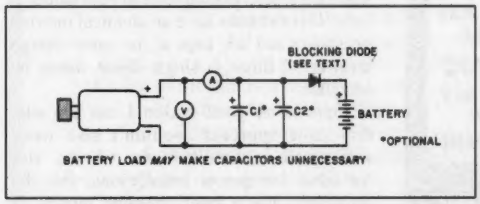

Fig. 4. Substitute a germanium diode for the silicon one and you can save a half volt or more because of the lower forward voltage drop.

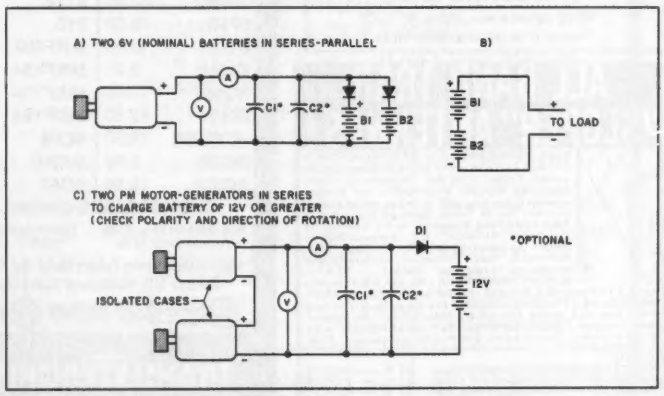

Fig. 5. (a) Two 6-V batteries in parallel while being recharged and (b) switched to series while in use. (c) Two motor generators in series.

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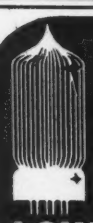

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tempts to get the voltage up by cranking the pedals harder or reducing the load were not very successful; there was a definite "peaking out" effect around 12 volts. This was either because the windings and core of the armature were becoming saturated, or because the mechanical load resistance was causing the friction wheel to start slipping, or some combination of both.

A blocking diode is usually desirable when you're trying to recharge a battery; without one current will tend to flow back through the windings from the battery, and the generator will start acting like a motor again. The forward series voltage drop of the junction, usually on the order of 1.7 to 1.8 volts for a silicon diode, adds to the necessary voltage that must be provided by the generator to yield any meaningful amount of charging current. Taking a trick from the solar-cell people allows us to minimize this: Substitute a germanium diode for the silicon one and you can save a half volt or more because of the lower forward voltage drop. One junction of a germanium bipolar power transistor, such as the audio transistors used in many automotive broadcast radios in the late 50s, will do as well and will probably be easier to come up with in the station junk box (see Fig. 4).

If a 6–10-volt battery is adequate for your QRP and emergency power needs, this setup will be fine as is. If you really need a full 12 volts, you must resort to sneaky techniques. One possibility is to use a pair of motors as generators and put their outputs in series. If you try this, you must be careful to observe the correct polarity of output and direction of armature rotation. Also, be sure that both leads of the motors you are using are isolated from the case. If they aren't, some kind of insulated mount must be used. You may also find that two motors and two sets of friction drive rollers put a much heavier mechanical resistance on the pedals, and the output you can sustain at a comfortable level of pedaling effort may be reduced substantially—see Fig. 5(c).

A good compromise for many Field Day operations would be the arrangement shown in Fig. 5. Two 6-volt motorcycle or Gel-Cell type batteries are placed in parallel while being recharged, but are then switched to series to provide 12 volts while in use. The most practical arrangement would be to have four 6-volt batteries or banks of cells, so that one pair is always available to power the rig while the other is being charged up. Two blocking diodes act as load dividers to help maintain even charging rates in both banks of cells. If both banks have an identical internal resistance and are kept at the same charge level at all times, a single diode would be adequate.

There is no good reason I can see why this same approach wouldn't also work with small windmills, water wheels, etc. for other low-power installations. For the *truly lazy*, use a small gasoline moped or string-trimmer engine, thereby creating Putt-Putt Propulsion for the Pedal-Pushing Power Plant. ■

Hi Pro Repeaters
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• AN EXTENSION PANEL IS AVAILABLE FOR LOCAL MONITORING OF THE REPEATER AND CONTAINS ALL NECESSARY METERING, STATUS LIGHTS AND INDICATORS. ALL ADD ONS ARE AVAILABLE FROM THE COMPANY AND ARE COMPLETE INCLUDING INSTRUCTIONS. THE Hi Pro "E" IS AVAILABLE IN NOVEMBER.

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27th ANNUAL

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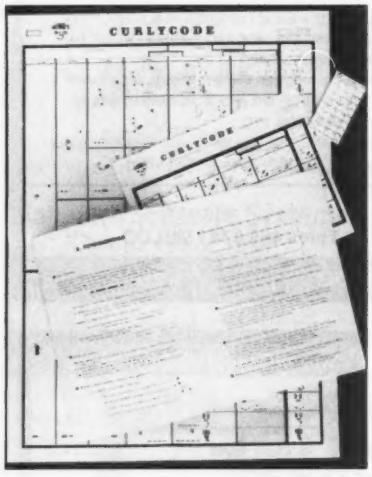
Holiday Buying Guide

TRANS COM CN-1

Trans Com, Inc. offers the CN-1 Packet Connect Alarm. When a connection is made to your TNC, a one-second alarm sounds alerting you to the call. The CN-1 attaches easily to any model TAPR-compatible TNC with only three connections.

The CN-1 comes fully assembled and tested for $16.95; for more details, please check Reader Service number 251.



Curlycode from Mind's Eye Publications.

MIND'S EYE CURLYCODE

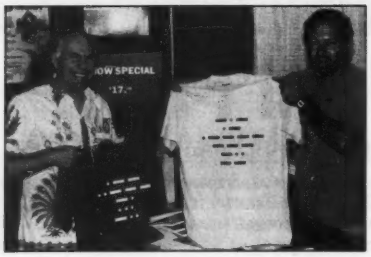
An unusual method for learning Morse code using rhythms and shapes is available from Mind's Eye Publications. Curlycode is a course designed either to teach code or to improve your code speed. The Curlycode system combines the rhythms of Morse code into shapes that are easily remembered; as you trace the shape you are tracing the outline of the letter being sent.

The basic Curlycode system costs $6.50, or $11.50 for the deluxe version, which includes wall charts and a handy pocket guide. Ten complete sets may be purchased at the discount rate of $91.50 including postage. For more information, check Reader Service number 252.

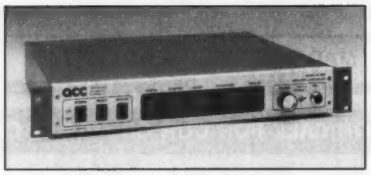
MORSE T-SHIRTS

Imagine your callsign emblazoned in Morse code across a red, light blue, orange, white, yellow, green, or black 100% cotton T-shirt. Choose fuzzy flock Morse characters in black, red, dark blue, or white. Sizes are men's small, medium, large, and extra large; all shirts are $14.50 plus $2.50 postage and handling (California residents please add 6% tax). Specify colors, size, and callsign (eight lines maximum).

For more information, check Reader Service number 253.



Fuzzy Morse T-shirts.



ACC's RC-850 repeater controller.

ADVANCED COMPUTER CONTROLS

Repeater Controllers

The RC-850 and RC-85 repeater controllers offer the advanced high-performance features that have made them the standard in amateur repeater operations. With the new ACC Digital Voice Recorder, repeater users can record voice messages for each other in a voice mailbox, and all of the repeaters' IDs and other messages can be stored. The ITC-32 Intelligent Touchtone™ Control Board provides extensive touchtone remote-control capabilities.

ShackMaster

ACC's ShackMaster multiplies the value of your home station by making it available for use from wherever you are. Crossband linking lets you operate your home HF station from your VHF hand-held, and telephone access lets you operate it from any telephone. Additional features include remote rotor control, a simplex autopatch, an intercom into the shack, and an electronic mailbox for communicating with the family.

For more information on ACC products, please check Reader Service number 254.

TRAC CMOS KEYER

The Trac Electronics model TE144 is just one of a full line of popular electronic keyers. The TE144 ($65.95) is a state-of-the-art CMOS keyer with self-completing dots and dashes, dot and dash memory, iambic keying, and speed, weight, tone, and volume controls. The keyer has its own sidetone and an internal speaker, and a rear-panel switch to allow semiautomatic or straight keying.

For more information on this and other Trac products, check Reader Service number 255.

The Trac model TE144 CMOS keyer.

Microcraft's Code★Star CW/RTTY/ASCII reader.

MICROCRAFT CODE★STAR

Microcraft's Code★Star decodes incoming Morse, Baudot, and ASCII transmissions and displays them on its eight large LEDs. The microcomputer auto-tracks Morse from 3 to 70 wpm in two optimized ranges. An automatic gain control circuit provides up to 16 dB of gain to keep locked to signals under changing conditions.

An optional serial/parallel output kit is available which provides a 110/300-baud buffered port to drive an ASR-33 or a computer terminal.

For more details, please check Reader Service number 256.

U.S. TOWER

U.S. Tower offers a wide variety of self-supporting towers for the radio amateur. Tower heights range from 33′ to 90′, and prices from $925 to $7,195. In addition to stock towers, the company is capable of building towers to your specifications.

For more information about U.S. Tower, check Reader Service number 257.

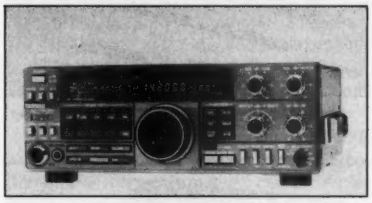
MFJ-949C VERSA TUNER II

MFJ is proud to introduce the model 949C Deluxe Versa Tuner II. The 949C will handle

300 Watts from 1.8 to 30 MHz, and will match coax, balanced feeds, or random wires. Swr can be easily read on the large cross-needle power meter. A 200-Watt 50-Ohm dummy load is included for interference-free tuneup.

For information on this and other MFJ products, please check number 258 on the Reader Service card.

The MFJ-949C Versa Tuner II.



Kenwood's TS-440S.

KENWOOD

TS-440S

Kenwood's TS-440S HF transceiver features all-band, all-mode coverage, a 100-kHz–30-MHz general-coverage receiver, direct frequency entry from the keyboard, and a built-in antenna tuner for 80 to 10 meters. The exclusive DynaMix™ mixing system offers a true 102-dB dynamic range. 100 memory channels store frequency, band, and mode.

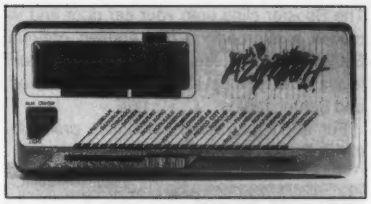
R-5000

The R-5000 high-performance receiver covers 100 kHz to 30 MHz in 30 bands, with additional coverage from 108 to 174 MHz (with the optional VC-20 converter installed). 100 memory channels are available for storing frequency, mode, and antenna information. Dual vfo's may be accessed directly with keyboard frequency entry. The R-5000 includes Kenwood's DynaMix mixing system for wide dynamic range, programmable scanning, and two built-in 24-hour clocks with timers.

TM-2570A

Choose one of three output power levels on 2 meters: the TM-2530A with 25 Watts, the TM-2550A with 45 Watts, or the TM-2570A with 70 Watts. All models feature 15 seven-digit telephone number memories, an auto-dialer, a high-performance GaAsFET front end, automatic repeater offset selection, and 23 memories which store frequency, offset, and subaudible tone information. Also available is the TM-3530A, a 25-Watt model for 220 MHz.

For more information about these and other Kenwood products, visit your local Kenwood dealer or check Reader Service number 259.



Azimuth's WT-80 World Time Clock.

AZIMUTH WORLD CLOCK

Azimuth Communication's new WT-80 World Time Clock features digital readouts with both local time and world time in a 24-hour format. The quartz clock operates from a single oscillator and uses a 24-position slide switch to show the time in 24 cities around the globe (UTC is displayed when London is selected). The clock also includes a button-operated light and a snooze alarm.

For more details, check Reader Service number 260.

WENZEL COUNTER-MATE

The Wenzel Counter-Mate is a personal frequency standard which provides stable 1- and 10-MHz signals to calibrate frequency counters. A third-overtone 10-MHz crystal mounted in a proportionally controlled copper oven is used for very low drift. Outputs will drive both TTL and 50-Ohm loads with a 5-ns rise/fall time square wave.

To get more information on the Wenzel Counter-Mate, check Reader Service number 261.

MJC TECHNOLOGIES SCORE

The Sweepstakes Contest Operating Results Enhancer is billed as the ultimate ARRL Sweepstakes contesting system. The software, which runs on the IBM PC and compatibles, handles all of the logging and duping tasks associated with the contest. In addition, SCORE will directly control the Heath SS-9000 transceiver and Pro-Search rotor controls; frequency and antenna direction are automatically entered into the log.

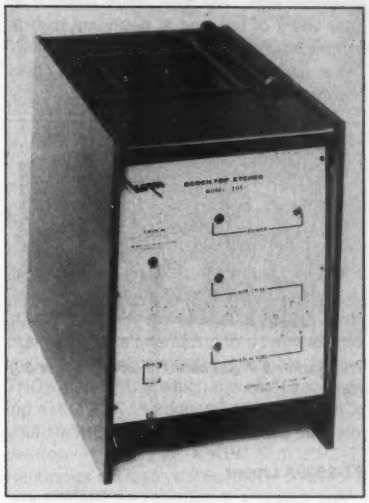
Real-time scoring information is displayed along with sections worked/needed. A variety of reports can be generated, including a complete log in callsign or contact order; a section-contact report, which lists the number of contacts for each ARRL section and the log information for the first contact in each section; an operating profile, which graphically displays band changes, QSO rates, and off periods; and a contest summary (required for Sweepstakes entries).

Demo disks are available to qualified clubs; for more details, please check Reader Service number 262.

TEXAS MAGNETICS

Texas Magnetics Corporation, the largest U.S. supplier of magnetic base assemblies for mobile antennas, is celebrating their 10th anniversary this year. TMC also manufactures Magna-Grab magnetic tool racks in two sizes; the TMC-100 is 13" long and the TMC-200 extends to 25". The racks are made of heavy-duty chrome-plated steel and are faced with a Kydex™ color bar. No assembly is required, and all mounting hardware is included.

For complete details on the Magna-Grab tool rack, check Reader Service number 263.

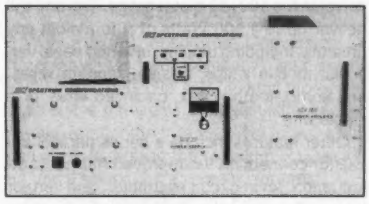


Kepro's bench-to-circuit etcher.

KEPRO PC ETCHER

This holiday season, etch a permanent smile on your favorite electronic hobbyist's face with the convenient, versatile, and economical Kepro Spray Etcher ($765). He'll love you for it. And, with the professional results he'll get on PC boards up to 12" x 12" in just five minutes, you'll love his projects.

For more information on the Spray Etcher and other Kepro products, check Reader Service number 264.



SCA-100 VHF/UHF amps from Spectrum.

SPECTRUM POWER AMPS

The Spectrum SCA-100 150-Watt VHF and 100-Watt UHF amplifiers can be used with any 10–40-Watt transmitter. Their large heat sinks and high-efficiency design ensure cool operation even when run at 100% duty cycle in a hot environment. The amplifiers also feature automatic vswr protection and automatic amplifier bypassing if the power supply fails or the amp overheats. Both amps are designed for 19" rack mounting. A companion power supply, the SCP-30, is also available.

For complete details on these and other Spectrum products, check Reader Service number 265.

SYNTHETIC TEXTILES ANTENNA ROPE

Due to the constant urging of a local ham,

Synthetic Textiles has developed a special double-braided Dacron rope for use in antenna installations. The rope is available in three sizes: 3/32", 3/16", and 5/16". The outer braid is color-sealed black Dacron for resistance to ultraviolet light. The rope unties easily even after years of use and is easily cut with an electric hot-knife (included with every spool).

For additional information, please check Reader Service number 266.

The Barker & Williamson PT-2500A linear amplifier.

BARKER & WILLIAMSON

PT-2500A Linear

The Barker & Williamson PT-2500A linear amplifier is a completely self-contained tabletop unit designed for continuous SSB, CW, RTTY, AM, or ATV operation. A pair of Eimac fast-warmup tubes provide 1,500 Watts output on 1.8–21 MHz (the amp can be modified for use in military or commercial applications). Other features include illuminated swr and power meters, vernier tuning for quick accurate settings, and a silver-plated tank coil for maximum efficiency.

VS-1500A Antenna Coupler

The B&W VS-1500A is designed to match virtually any receiver, transmitter, or transceiver in the 160–10-meter range. The unit will deliver up to 1,500 Watts of rf to almost any antenna, including dipoles, inverted vees, verticals, mobile whips, beams, random wires, and so on, fed by coax, balanced lines, or a single wire.

Other features include a series/parallel capacitor connection for improved harmonic attenuation, an in-circuit wattmeter, and vernier tuning. Front-panel switching allows for rapid selection of antennas or a dummy load.

For details about these and other B&W products, please check Reader Service number 267.

MISSION CONSULTING

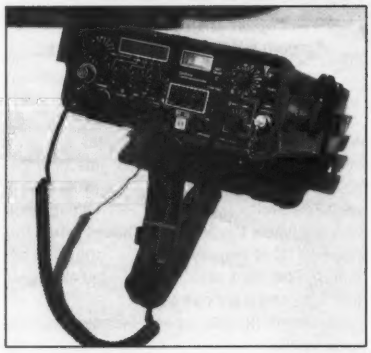
MP-25 Transceiver

Mission Consulting's MP-25 25-Watt SSB synthesized manpack transceiver covers the 2–15-MHz range in 100-Hz steps. This lightweight, immersible radio features a built-in antenna tuner and speaker, and meets MIL-STD-108. Several optional accessories are available for use in fixed operation.

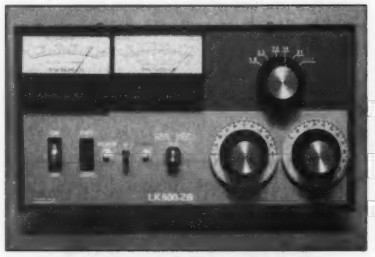
Docking Booster

Boost the range of your HT while operating mobile by increasing its output to 30–50 Watts with Mission Consulting's Docking Booster. The Booster clips onto your car door and includes a microphone clip and an optional GaAsFET preamplifer. The Docking Booster is available for most ICOM, Yaesu, Kenwood, and Santec radios.

For additional details on these products, check Reader Service number 268.



Mission Consulting's MP-25 portable transceiver.



Amp Supply's LK500-ZB linear.

AMP SUPPLY LK500-ZB

This self-contained amplifier delivers 1,500 Watts of rf from 1.8–22 MHz and features a Peter Dahl Hipersil power transformer, an ITT Jennings vacuum antenna-changeover relay, and a companion sealed-relay QSK system. The HF tank coil and Centralab bandswitch are silver-plated. A no-tuneup version of the LK500, the LK500-NTB, is also available.

For further details on Amp Supply linears and accessories, circle Reader Service number 269.

CERTIFIED COMMUNICATIONS

Press Jones N8UG of Certified Communications supplies all of the wire and cable needed by hams. Certified also carries accessories such as insulators, connectors, baluns, ground rods, toroids, and so on. Custom baluns, feedlines, and center insulators can be made to order. Over 3,000 CB-to-10 conversions are in Certified's files.

For more information, please check Reader Service number 270.

RADIO WORKS

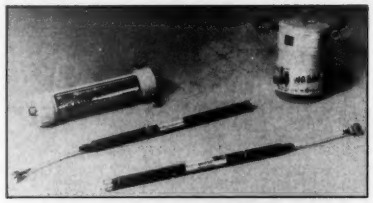
B and C Series Baluns

Radio Works' B and C series baluns, in either 4:1 or 1:1 versions, achieve a balance of wiring inductance, core characteristics, coupling, and construction to produce a well-behaved broadband balun. Prices start at $15.95.

Superloop

The Superloop is a high-performance, automatic-bandswitching loop antenna for 80 and 40 meters. The design uses a decoupling stub in combination with a Dedicated Tuning Unit at the feedpoint for reactance control. The loop is slightly short of a full wave on 80 meters and exhibits gain on 40 meters and higher bands.

A free 32-page catalog is available from Radio Works; check Reader Service number 271.



New baluns from Radio Works.

The Regency R806 crystal-controlled scanner.

REGENCY R806 SCANNER

Regency's 8-channel R806 crystal-controlled scanner is ideal for listeners who don't need a fancy synthesized unit. The R806 covers 30–50 MHz, 144–174 MHz, and 440–512 MHz. Other features include a programmable priority control, dual scan speeds, and channel lockout. The scanner is designed for mobile or home use and comes with a mobile mounting bracket, an ac power cord, a dc power cord, and a telescoping antenna.

Get more information on Regency products by checking Reader Service number 272.

The Tuner Tuner from Palomar.

PALOMAR TUNER TUNER

Palomar Engineers have announced their new Tuner Tuner™, which connects between

your transceiver and your antenna matching unit. With the Tuner Tuner you can adjust your AMU without putting a signal on the air. The built-in 50-Ohm noise bridge gives an audible null when the tuner matches the coax line to 1:1 swr.

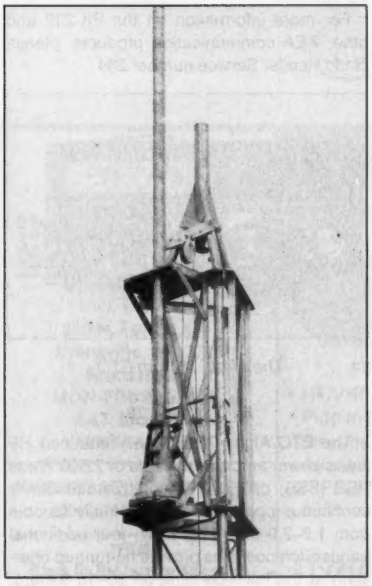
For more information, please check Reader Service number 273.

PAC-COMM DR-100/DR-200

Pac-Comm is manufacturing packet repeater controllers designed expressly for the needs of packet radio networks and remote, unattended operation. The DR-100 provides a basic single-port controller useful for single-frequency digipeaters. The DR-200 is a dual-port controller designed to be an inexpensive, off-the-shelf packet switch for moving traffic on inter-LAN networks.

Both units are designed around the Z-80 CPU with up to 32K bytes of EPROM storage and 32K bytes of RAM. HDLC is handled by a Z-8530 Serial Communications Controller. The DR-200 has two independent 300/1200-baud modems (AMD 7910 World-Chip™), while the DR-100 has only one modem. Both models support an external terminal.

Several versions of single- or dual-port software are available at no cost through Pac-Comm. For more information, check Reader Service number 274.



The Hazer system.

MARTIN ENGINEERING HAZER

The Martin Hazer is a unique tower accessory that raises and lowers antennas directly up and down the tower. The Hazer is assembled at ground level. An antenna and rotor are fitted to the Hazer, then the entire assembly is winched to the top of the tower. A spring-loaded safety catch engages at every cross brace. At the top, the safety catch transfers the weight of the antenna to the tower.

For more details, check Reader Service number 275.

FOX TANGO ANNIVERSARY

To celebrate his 78th birthday and the 15th anniversary of the founding of Fox Tango, president Milt Lowens N4ML has announced a spectacular sale on his 8-pole FT Crystal Filters for radios from Kenwood, Yaesu, ICOM, Drake, and Collins. Milt bought a bunch of these when the Yen was low, and until the stock runs out he will pass the savings on to you.

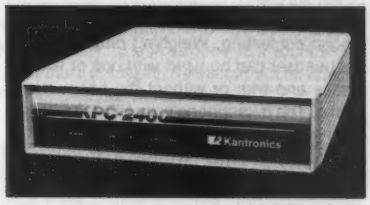
For more information on Fox Tango filters, check Reader Service number 276.

ICOM's μ2A 2-meter hand-held.

ICOM MICRO 2AT

ICOM's new IC-μ2AT is a pocket-sized 2m hand-held designed to cover 139–174 MHz on receive and 140–150 MHz on transmit. The Micro features ten memories to store frequency, offset, and access tone; an LCD readout on the top panel; scanning; 1 Watt rf output; and 32 built-in subaudible tones. The HT weighs 1/2 pound and measures 2.3" x 5.6" x 1.1".

For complete details, please circle Reader Service number 277.



New 2400-baud TNC from Kantronics.

KANTRONICS

KPC-2400

The KPC-2400 Packet Communicator combines the KPC-2 300/1200-baud TNC with a 2400-baud PSK modem for high-speed packet operation. An RS-232C/TTL jumper is included to make interfacing to a terminal simple. An add-on modem is available for the TNC-1 and TNC-2 which mounts directly on top of the TNC. It adds 2400-baud packet to your station while maintaining 1200-baud operation. If you own a KPC-1 or KPC-2, Kantronics will take your old unit in trade for a new KPC-2400.

KPC-2

The KPC-2 Packet Communicator features a built-in HF modem, full duplex operation, multiple connects, and over 100 software commands. The unit comes with 128K of EPROM, 16K of RAM (expandable to 32K), and 4K of EEPROM. Any terminal program can be used with the KPC-2; Kantronics offers Pacterm programs for the Commodore VIC-20 and C-64, and the TRS-80 III, 4, and 4P.

For a free catalog of Kantronics equipment, check Reader Service number 278.

PETER DAHL

With a 516F2 Solid-State Conversion kit from the Peter Dahl Company, your power supply will run cooler and gain full protection against line transients. You get solid-state replacements for the 5U4 and 5R4 tubes, a silicon diode to replace the selenium bias rectifier, and a selenium transient suppressor.

For more information on Peter Dahl products, check Reader Service number 279.

HEIL SOUND

SS-2 Magic Box

The Heil SS-2 system contains two 5-Watt amplifiers, a 3.5" air-suspension woofer with an 8-ounce magnet, and a 1.5" hard dome tweeter. Unlike the usual "hi-fi" speaker which has a crossover of about 7 kHz, the Heil SS-2 crossover is at 1.5 kHz, right in the articulate range of an SSB signal. The amplifiers have a 4-dB gain peak in the 1.5–2.5-kHz range to give extra punch to the audio.

Headset Control System

The HCS Headset Control System from Heil is designed for the serious radio operator. The HCS is made up of the BM-10 Boom Headset,

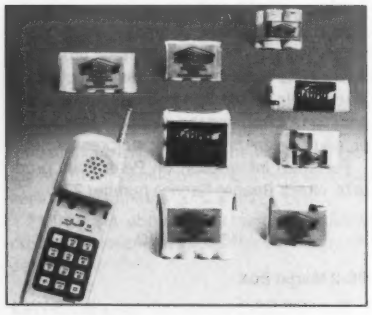
the HCS Interface Amplifier, and the PRS power supply.

The BM-10 is specially designed for prolonged contesting. Weighing only 8 ounces, the headset can be used with one or two ear pieces and with or without the boom microphone. The microphone is an HC-4 DX Dream Machine and has a 10-dB peak at 2.1 kHz with a sharp rolloff (12 dB per octave) at 600 Hz.

The HCS Interface Amplifier contains a dual-channel 2-Watt audio amplifier with a two-input mixer. When used in stereo mode, one radio can be heard in the left ear and another radio in the right ear. An additional output allows a logger to listen in, and an intercom switch disconnects the radios to allow the operator to talk with the logger.

For more information on Heil Sound equipment, please check Reader Service number 280.

The SS-2 Magic Box from Heil Sound.



A variety of replacement nickel-cadmium batteries are available in JaBro's new catalog.

JABRO CATALOG

An updated 16-page catalog of replacement nickel-cadmium batteries is now available from JaBro. Additions to their line include replacements for the RCA Tac-Tec 747, Ritron's RT-156, and the Standard BP-11, as well as inserts for Midland models R70-B08 and R70-B12, the Repco 816 and 817, and Motorola's MH-70 and MH-10.

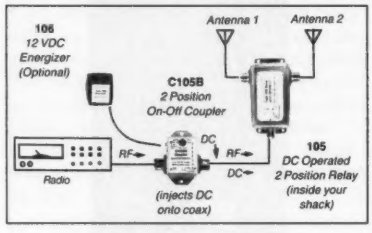
For more information, check Reader Service number 281.

Coaxial Dynamic's model 81000-A rf wattmeter.

COAXIAL DYNAMICS

The model 81000-A Directional Rf Wattmeter is an inexpensive test instrument designed to measure forward or reverse power in coaxial transmission lines. Forty-seven standard and forty-seven special plug-in elements are available, covering power levels from 100 milliwatts to 5,000 Watts and frequencies from 2 MHz to 1,000 MHz. The 81000-A comes with N connectors, but any connector may be specified, including 7/8" silver flange. Maximum vswr is 1.05:1 with N connectors installed.

The 81000-A is one of a series of economical rf test equipment from Coaxial Dynamics; for more information, check Reader Service number 282.



Antennas Etc.'s remote switching system.

ANTENNAS ETC.

Baluns

Antennas Etc. offers a complete line of W2AU and W2DU baluns for both HF and VHF installations. Models are available to handle up to 9,000 Watts from 1.8–30 MHz and up to 4,000 Watts from 30–300 MHz in 1:1 and 4:1 configurations. W2AU ferrite-core baluns are $17.95, and W2DU non-ferrite baluns are $19.95.

Remote Switching

A remote switching system is available from Antennas Etc. which allows you to feed multiple antennas off of one coaxial feedline. The C105B system will handle up to 1250 Watts from 1.5–180 MHz, and uses a remote dc relay for switching.

For complete details on these products, please check Reader Service number 283.

AEA's PK-232 Pakratt.

AEA PK-232

The new AEA Pakratt model PK-232 is a multimode data controller with the ability to connect any RS-232-compatible computer or terminal directly to a transceiver. The PK-232's internal software handles the decoding, signal processing, and protocol for CW, Baudot, ASCII, AMTOR, and packet operation. Twenty-one front-panel indicators are used to display the operating mode and status.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the correct filter parameters.

For more information on the PK-232 and other AEA communication products, please circle Reader Service number 284.

The Alpha 78 from ETO.

ETO ALPHA 78

The ETO Alpha 78 is a self-contained HF linear power amplifier capable of 2,000 Watts PEP (SSB) or 1,000 Watts constant-carrier continuous operation. It is manually tunable from 1.8–2.0 and 3–22 MHz; four additional bandswitch positions provide no-tuneup operation at the full legal limit on 80–15 meters. The 78 is capable of QSK CW and features full-cabinet forced-air cooling with a ducted exhaust.

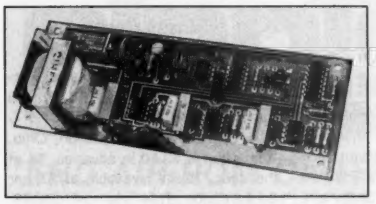
For more information, check Reader Service number 285.

UNTENNA HI-RIZER

The engineers at Untenna have taken a full-sized 40–10-meter vertical and wound it down to a manageable size: 15 inches. Three mounting options are available: a magnetic or clamp mount for use over a large metal surface and a ground screen. The ground screen is a 24" x 30" piece of hardware cloth and only acts as a ground plane on 15 and 10 meters.

20- or 40-meter operation is accomplished by using a 1/2-wave length of coaxial cable (furnished), making a 3/4-wave system on 40 meters and a 5/4-wave system on 20 meters. Tuning is done by tapping the helical radiating element and extending the two capacity-hat whips.

For more details on Untenna products, check Reader Service number 286.



Melco's Hi-Pro BAP.

MELCO BAP

Maggiore Electronic Laboratory (Melco) now offers the Hi-Pro Basic Auto Patch, a single-board controller with all of the functions necessary to implement an auto patch. Features include an adjustable dual-tone two-digit decoder, an adjustable time-out timer, an external disable line, single-supply power, and full-duplex operation. The unit draws only 30 mA at 10–15 V dc.

For more information, please check Reader Service number 287.

Ten-Tec's RX325 general-coverage receiver.

TEN-TEC RX325

The RX325 is Ten-Tec's newest general-coverage receiver. The rig is fully synthesized from 300 kHz to 30 MHz and features 25 memories, an S-meter with a SINPO scale, a built-in rf preamp, programmable band and memory scanning, and 12 V dc or 120 V ac operation.

For more details, please check Reader Service number 288.

ASTATIC D-104 SILVER EAGLE

Astatic's D-104 Silver Eagle is the result of 50 years of research. It combines a vibrant chrome finish and engraving with a versatile microphone system. The D-104 Silver Eagle will make any rig look as good as it sounds.

For more details on Astatic products, check Reader Service number 289.

The D-104 Silver Eagle.

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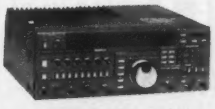

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SPECIAL EVENTS

RICHFIELD MN
NOV 1

The Twin City FM Club will sponsor the second annual Hamfest Minnesota and Computer Expo on November 1, from 7:30 a.m. to 3 p.m., at Richfield High School, 7001 Harriet Avenue South, Richfield, Minnesota. Admission is $3 in advance, $4 at the door. FCC exams given. Talk-in on .16/.76. For more information or advanced registration, send an SASE to Hamfest Minnesota and Computer Expo, Box 555, Minneapolis MN 55440, or to Lyle Vogt KA0UDL, 5130 Willow Lane, Minnetonka MN 55345.

LAWRENCEVILLE GA
NOV 1–2

The Alford Memorial ARC of Stone Mountain will sponsor Ham Radio and Computer Expo '86 on November 1–2, from 9 a.m. to 5 p.m. Saturday and from 9 a.m. to 4 p.m. Sunday, at the Gwinnett County Fairgrounds, 20 minutes northeast of Atlanta. Admission is $4 in advance, $5 at the door. VEC license exams given both days. Talk-in on 146.16/.76 or 449.250/444.250. For more information, contact the Alford Memorial ARC, PO Box 1282, Stone Mountain GA 30086, or call N8LM at (404)-925-7615.

SOUTHFIELD MI
NOV 2

The Oak Park ARC will hold its largest Swap-N-Shop on November 2, from 9 a.m. to 5 p.m., at a new location: the City of Southfield Civic Pavilion, Evergreen Road, between 10 and 11 Mile Roads in the northwest Detroit suburb of Southfield, Michigan. Admission is $4, children under 12 free, VE3s at par. Tables $10. Fire regulations restrict the number of tables. Advanced reservations required. Talk-in on DART 146.04/.64 and 146.52. For further information, send an SASE to OPARC Swap-N-Shop, 303 South Vermont Avenue, Royal Oak MI 48067, or call the Swap-N-Shop hotline: (313)-399-3991.

SELLERSVILLE PA
NOV 2

The RF Hill ARC will conduct its 11th annual hamfest on November 2, beginning at 8 a.m., at the Pennsylvania National Guard Armory, PA Rte. 152, Sellersville, Pennsylvania. Admission is $4 per ham, with accompanying non-ham spouse and children admitted free. Dealer space is $8 per 8-foot by 6-foot space inside and $6 per 8-foot frontage outside. No tables provided. Talk-in on 144.71/145.31, 146.28/146.88, or 146.52. For additional information or to reserve space, call Frank Benner W3BRU at (215)-257-2450, or write Hamfest Chairman, RF Hill ARC, 523 Vine Street, Perkasie PA 18944.

LAS VEGAS NV
NOV 7–8

HAM/WEST and the ARRL Nevada State Convention will be held all day November 7 and 8 at the Hacienda Hotel in Las Vegas, Nevada. Advance registration is $12 before October 24 or $15 at the door. For all info, see the ad on page 11 of this issue or contact HAM/WEST, PO Box 19675, Las Vegas NV 89132; (702)-361-3331.

DALLAS/FORT WORTH TX
NOV 7–9

AMSAT will hold its fourth annual Space Symposium and Annual Meeting at the Dallas/Fort Worth Airport Hilton Hotel on November 7–9. Speakers at the Saturday symposium include experts from around the world who will address the latest in OSCAR news including FO-12, Phase 3C, and the new Phase 4 program. For additional details and registration information, call AMSAT HQ at (301)-589-6062.

NEWMARKET ONT
NOV 8

The York Region ARC will hold the 10th edition of The Newmarket Fleamarket on November 8, from 0900 to 1500, at Huron Heights Secondary School in Newmarket, Ontario. General admission is $3, children under 12 are admitted free. Tables are $5 and must be reserved in advance. Contact Geoffrey Smith VE3KCE at 7 Johnson Road, Aurora, Ontario L4G 2A3, Canada; (416)-727-6672 (after 1830). Talk-in on 146.520 and 147.225/147.825. The Radio Society of Ontario will be organizing seminars beginning at 1600 at St. Andrew's College, 300 Yonge Street North, Aurora, Ontario. For information about a banquet following the seminar, contact Evan Herriott VE3IND, 8 Lindal Avenue, Scarborough, Ontario M1L 1W8, Canada; (416)-757-4284 (after 1630).

HOT AIR BALLOONS
NOV 8

The L'Anse Creuse ARC will celebrate the flight of hot air balloons on November 8, from 1200–1500 and 2000–2230 UTC, by operating from hot air balloons on 7.263 ±QRM and 147.420. Alternate weather date will be November 15. For certificate, please send QSL and 9 x 11 SASE to A. C. Koch KA8JJN, 23682 Kim Drive, Mt. Clemens MI 48043.

FORT WAYNE IN
NOV 9

The Allen County Amateur Radio Technical Society will present the 14th annual Fort Wayne Hamfest on November 9, from 8 a.m. to 4 p.m., at the Allen County Memorial Coliseum on Coliseum Boulevard (U.S. 30). General admission is $3.50 in advance, $4 at the door, children 11 and under free. Standard tables $10, premium tables $25. Talk-in on 146.28/.88, 443.8/448.8, and 147.255/.855. VE exams given on Saturday, November 8 with advance registration only. For more information or reservations, contact ACARTS Hamfest, PO Box 10342, Fort Wayne IN 46851. For information only, call Bernie Holm K9JDF, Hamfest Chairman, at (219)-485-0164 between 6 and 10 p.m. EST; no reservations accepted by telephone.

NORTH HAVEN CT
NOV 9

The SCARA annual indoor flea market will be held on November 9, from 9 a.m. to 3 p.m., at the North Haven Park and Recreation Center in North Haven, Connecticut. Admission for buyers is $2. Tables $10 in advance, $15 at the door (if available). For information or table reservations, send an SASE and phone number to SCARA Flea Market, PO Box 81, North Haven CT 06473. Reservations must be received by November 3. For information only, contact Brad at (203)-265-6478 (7–10 p.m.). No reservations will be taken by phone.

"PAPPY" WADE MEMORIAL
NOV 9

In observance of Veterans' week, members of the Hamfesters RC will operate the club's 2nd annual special-event station from the Hines V.A. Hospital's Robert K. "Pappy" Wade K9CDH Memorial Ham Shack, using the Hine's club call K9WFN, on November 9 from 1500–0300 UTC (9 a.m. to 9 p.m. local time). The club will operate on 40m, 20m, 2m FM, and 2m USB. Frequencies to be used are 14.260, 7.260, 146.43, and 144.210. Send QSL, QSO number, and a 9 x 12 SASE to Hamfesters Radio Club, Inc., Chicago, c/o Robert K. "Pappy" Wade Memorial Ham Shack, Bldg. 8, Hines Veterans Administration Hospital, Hines IL 60141.

VETERANS DAY
NOV 9–11

Armored Forces Amateur Radio Net will operate from 1700 UTC November 9 to 2400 UTC November 11, on 10–80 meters, in recognition of Veterans Day. Frequencies: phone—7.283 and 3.920–3.925; CW—7.000. Contact any AFAR member. Send a #10 SASE to WB1DWR AFAR Net, 16 Berkeley Circle, Newington CT 06111.

MILWAUKEE WI
NOV 15

The Milwaukee Repeater Club will sponsor the 2nd annual 6.91 Friendly Fest on November 15, from 8 a.m. to 1 p.m., at The Eagle's Club, 24th and Wisconsin Ave, Milwaukee. Tickets are $3, 4-foot tables are $4. To save $1 per ticket or table, send SASE with payment to The Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201, before November 8. Talk-in on 146.91/.31 and 146.52. Exams given at 9 a.m.

ORANGE NJ
NOV 16

The West Orange Repeater Club will hold a hamfest on November 16, from 9 a.m. to 3 p.m., at the Orange Elks, 475 Main Street, Orange, New Jersey. Admission is $3 for buyers, $10 for sellers (per table). Talk-in on 224.80 or 146.550. For further information and ticket reservations, call Mike or Rob at (201)-674-0507 any time.

MASSILLON OH
NOV 16

The Massillon ARC will sponsor Auctionfest 86 on November 16, from 8 a.m. to 5 p.m., at the Massillon K of C Hall, off Rte. 21, in Massillon, Ohio. Admission is $3.50 in advance, $4 at the door. Tables available at $7 per 8-foot space. Talk-in on 147.78/.18. For advance registration and information, contact MARC, PO Box 73, Massillon OH 44646. Include an SASE.

BILLERICA MA
NOV 22

The Honeywell 1200 RC (sponsor of the 147.72/.12 repeater) and the Waltham ARA (sponsor of the 146.04/.64 repeater) will hold their annual amateur radio and electronics auction on November 22, beginning at 10 a.m., at the Honeywell plant, 300 Concord Road, Billerica, Massachusetts, Exit 27 off Rte. 3. Talk-in on both repeaters. For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

GREENSBORO NC
NOV 22–23

The Mark 4 RC will hold its 6th annual Greater Greensboro Hamfest on November 22–23, from 9 a.m. to 5 p.m., at the National Guard Armory, Franklin Blvd., Greensboro, North Carolina. Admission is $4 in advance, $5 at the gate. $9 for 6-foot inside flea-market table. Walk-in exams will be given by AE4N/Mark 4 VEC; call (919)-852-1087. For general information or advance tickets, contact Fred Redmon N4GGD, 3109 Goodall Drive, Greensboro NC 27407; (919)-852-9244 (9–11 p.m.)

OAK PARK MI
NOV 30

The Oak Park High School Electronics Club will hold the 17th annual Swap-N-Shop on November 30 at Oak Park High School, Oak Park MI 48237. Donation is $2. $8 for an 8-foot table.

XMASTIME AWARD
DEC 1–31

The Hen House Gang will be sending out the Christmastime Bethlehem and Santa Award during the month of December. Operation is on 10m, 20m, 40m, and Novice CW. For the Santa envelope and fold-up card, send a first-class stamp only; envelopes will be provided. For more information, write to the club president, Robert J. O'Neil W1FHP, Hard Hill Road, Bethlehem CT 06751.

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from page 14

So, let me know if you actually need to have a contest to get you to fulfill your civic responsibilities and work some Novices. We can have the Work A Young Novice Event certificate, keeping you up all night over a weekend or two collecting Novice contacts. I think we'll get 'em more involved with amateur radio if you'll actually talk with them—maybe Elmer a little. Let 'em know hamming really is fun.

If you do this and it works—write. If you do it and it bombs for you—write. If you don't do it go soak your head and let me know how that feels. Soaking one's head isn't like it was when I was a kid and there was that rain barrel of icy cold water out by the back door. We saved the rain water to rinse out things—like thunder jugs. Know what they are? Or watering the garden.

What else can we do to help make hamming enough fun for Novices so they'll go for a General? Any ideas? We're working on a series of articles to help 'em understand how radio works—and electronics. With Bash gone, what'll we do—what'll we do?

HAM POVERTY

Not to beat this to death, but the more I read the business magazines, the more I find them echoing my sentiments. *INC* had a particularly interesting article on why blacks have fallen so far behind economically. Both the Asians and the Hispanics have zoomed way ahead of blacks in family income.

The article pointed out that one basic problem has to do with the black perception of success—a cultural problem. They look upon ministers, teachers, and government workers, rather than businessmen, as successes. Thus, instead of starting small businesses, blacks tend to go for low-paying, but to them more prestigious jobs.

Indeed, even when blacks go into business successfully they do not gain prestige in the eyes of other blacks. Blacks in business complain that their fellow blacks refuse to patronize them. You don't see that with Hispanics or Asians. These groups are very protective and supportive of their entrepreneurs.

When I visited Kenya and Uganda twenty years ago, I wondered why there were virtually no black-run small businesses. I talked about this with the local black people and found that blacks wouldn't support black-run stores, preferring to shop at Indian-run stores. Even when the black governments, in desperation, funded black business start-ups, they failed.

In my recollection no other group of American immigrants has done this to themselves. The Irish made sure that Irish-run businesses got their business—as did the Italians when they arrived—and the Jewish.

When you consider that half of the jobs in our country are in small businesses, and about 90% of the more recent new jobs are in this fast-growing sector, it's obvious that entrepreneurs and small business are by far the most important to nurture for the growth of our country.

We've been losing manufacturing jobs to lower-wage countries—and we'll lose more, no matter how the government finagles with protectionism. If it weren't for our keeping out foreign agricultural products and supporting the higher U.S. prices for food, we'd probably lose our farming industry, too. This has led to the ridiculous situation where Senator Dole, in order to protect his state's farmers, has forced the U.S. to pick up a good deal of the tab on wheat sent to Russia—which helps keep down the Russian costs of decimating Afghanistan and escalates our deficit by about $30 billion. Is Dole someone we're seriously considering for president?

So what does all this mean to you, the *73* reader? Well, unless you're already into being an entrepreneur, you're probably having to make tough decisions. As you get to be my age and the doom of retirement hangs over you, you're suddenly very aware of the miniscule dole you're going to get back for all those dollars you thought you were investing in Social Security. The government has been careful not to let it be widely known that this has been primarily a tax, not insurance. So, as Eisenhower put it, they've taken away your dollars and will give you back dollarettes. And not very many of 'em either. Great scam! Certainly you won't get enough so you can comfortably subscribe to *73*, *QST*, *CQ*, and *Ham Radio* every year. And not enough so you can join me for a few days on an occasional Caribbean DXpedition—or a fun trip to Asia.

Perhaps you've noticed that once women started working in larger numbers, generating two incomes per family, the prices of houses and cars adjusted to the higher family income—as has almost everything else. It's almost entirely the extra money from two-income families which has made it possible for most small businesses to get started.

You as an amateur have an edge on being an entrepreneur. First, your family income is way above average. Second, you have a better than average education. Third, you have a decided edge in technology, which is where the bulk of the opportunities lie for starting new businesses.

Unless you've wasted your opportunities as a ham to learn about electronics, you're in a great position to start a small spare-time business at home. I'd like to hear from readers who've done this so other *73* readers can get ideas. I know there's an almost infinite need for technicians able to repair computers. And that's sure easy to get into. First you buy your own computer. It will break (that's a guarantee). After you've sweated out your own you'll find friends begging you for help. Jump at it and learn all you can. Start passing the word—then perhaps your business card to local businesses. The next thing you know your kitchen, garage, and cellar will be piled with computers waiting for you to fix and your phone will be ringing day and night as frantic businessmen plead to get 'em back so they can keep their businesses going.

I've mentioned the enormous opportunities in security installations for homes and businesses. A new home business is developing in desktop publishing, where a $10,000 investment puts you into business.

If you're short on imagination you should be reading magazines such as *Success*, *INC*, *Business Week*, *Forbes*, and so on. They're filled with ideas. I also get ideas from reading the science magazines such as *Discover*, *Omni*, *Popular Science*, and so on. If I could find the support people to make things happen, I could get a hot new business started at least once a week. Sadly, finding people with the ability and enthusiasm to take an idea and make it work is extremely difficult.

Oh, I try. I recently mentioned a chap I hired who had every opportunity and blew it by building a large staff and endlessly planning, but no sales. Now he's mad at me because he was finally—after wasting several hundred thousand dollars—fired. Another chap was given one potential small business after another to start up—blew 'em all. Nice chap, but unable to either follow directions or replace them with intelligent decisions.

Continued on page 98

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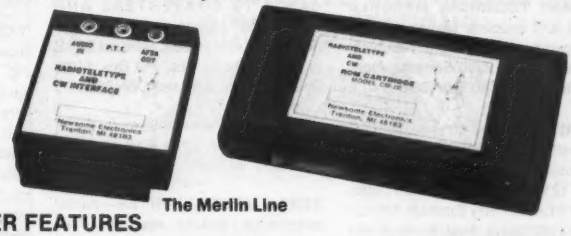

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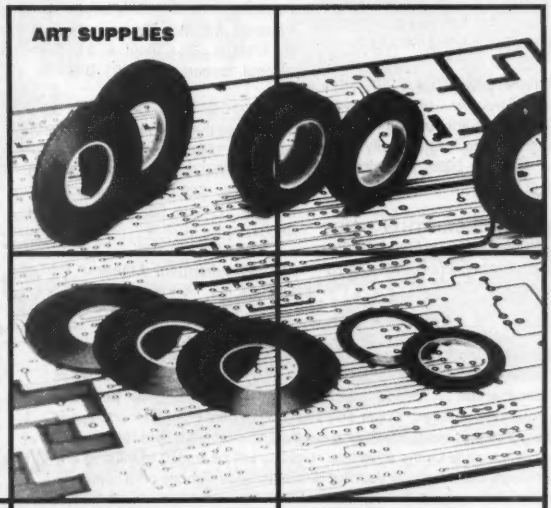

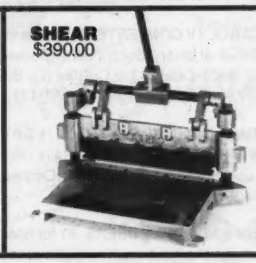

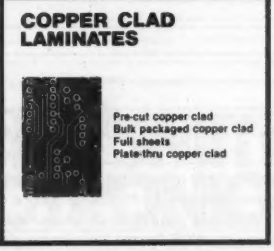

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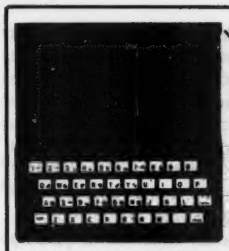

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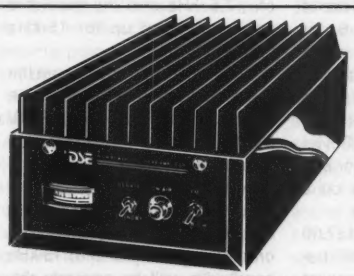

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RECEIVERS

The first three months of this column, of which this is number two, have one feature in common—there has not yet been time for reader input as to what subjects you would like to see discussed! When reader input gets thin, or nonexistent in the case of the first three columns, I will fall back to the "safe" strategy of discussing something of general interest.

For this month, the subject will be receivers. I might have started with antenna systems, but in the case of the VHF frequencies where most people are going to get started, antennas are fairly noncritical, at least for starters. The *Weather Satellite Handbook* describes several options for VHF satellite antennas, and even small two-meter antennas (3–5 elements) can be pressed into service to snag your first pictures. What you cannot fudge on is the receiver. Unless it meets certain minimum requirements, you may hear the satellite with a strong and consistent signal but you will *not* be able to get a decent picture.

To understand this seeming paradox, it is necessary to understand some aspects of the rf formats employed in weather satellite transmissions of potential interest to amateurs. All of the weather satellite transmissions you are likely to be interested in are transmitted in an FM format. When you choose a suitable FM receiver, the three primary criteria are sensitivity (noise figure), frequency coverage, and bandwidth.

Sensitivity/Noise Figure

Sensitivity is not a problem, despite the fact that we want the lowest practical noise figure, since an outstanding preamplifier can be added to any receiver that meets our other requirements. Modern GaAsFET preamplifiers for two meters (144–148 MHz) are available off the shelf with noise figures below 1 dB. Many of these are available in weatherproof housings for mounting at the antenna (a very good idea to eliminate the problem of transmission line losses). Virtually all of these can be retuned to cover the 137–138-MHz VHF satellite band, and many manufacturers will retune them for you when you place an order.

We will look at some available units in future columns, but the bottom line is that if you have a receiver that is suitable in other respects, noise figure/sensitivity can be brought up to any needed requirements very easily. Of course standard MOSFET and JFET preamps can be used as well. I would avoid bipolar preamps, as these have a tendency to overload, particularly in areas with a lot of rf crud.

Frequency Coverage

The frequency range of interest is fairly narrow, with all polar orbit transmissions confined to the 137–138-MHz range. U.S. TIROS/NOAA polar orbit transmissions are made on frequencies of 137.50 and 137.62 MHz. Each of the two operational spacecraft that are ideally in service at any one time will use one of these frequencies. NOAA-6, for example, uses 137.50, while NOAA-9 uses 137.62. Each has backup capability on the alternate frequency should a primary transmitter failure occur. Soviet METEOR/COSMOS weather satellite transmissions occur on a wider variety of frequencies.

In the past, 137.15 and 137.30 MHz were the two "prime" frequencies, and there still appears to be an operational METEOR spacecraft—and often more than one—on 137.30 MHz most of the time. In recent years 137.85 MHz has been used quite regularly, although other "oddball" frequencies in this range are active on an occasional basis. Whether this is by design or due to transmitter control problems is uncertain. In any case, your receiver must cover 137.50 and 137.62; 137.30 and 137.85 are desirable options.

Reception of geostationary WEFAX transmissions on 1691 and 1694.5 MHz (the latter used only by the European METEOSAT) is usually accomplished by using a converter ahead of the basic VHF FM satellite receiver. LO injection for the converter is adjusted so that the desired signal comes out at one of the "standard" VHF satellite frequencies (usually 137.50 MHz).

Bandwidth

Bandwidth turns out to be one of the biggest hurdles to overcome since all of the various satellites use deviation values that are significantly higher than those employed for standard FM voice links. The biggest market for FM receivers, if we leave out FM broadcast and TV sound, is for various kinds of scanners operating in the police and public-service bands. These transmissions typically deviate a maximum of ±7.5 kHz and the receivers are usually set up for 15-kHz bandwidth.

Unfortunately, if you tally up the values for signal deviation for a spacecraft such as the TIROS/NOAA series (±18 kHz) and Doppler shift (±3 kHz), you end up with a required bandwidth in excess of 40 kHz! A signal from one of the polar orbiters, received on a typical scanner with 15-kHz bandwidth, will be severely distorted and will not produce a usable signal. A straight carrier will sound fine, but a modulated signal is a mess. Although deviation levels are lower for the Soviet METEOR polar orbiters and the geostationary GOES and METEOSAT spacecraft, their signals are still too wide for satisfactory reception with a stock 15-kHz-bandwidth receiver. You would face exactly the same problem if you put a converter on an old two-meter receiver!

Receiver bandwidth is typically set by one or more filters in the i-f chain. There is almost always a crystal or ceramic filter at the 10.7-MHz first i-f and there is often another, usually ceramic, at the 455-kHz second i-f. If the receiver employs a crystal or ceramic filter at 10.7 MHz, it can often be widened by simply adding an inexpensive 30-kHz crystal filter in place of the original. A cheap 30-kHz filter will have very wide skirts and you will end up with a receiver with sufficient bandwidth to do the job. In contrast, a good 30-kHz filter will have steep skirts and the receiver will still be too sharp for TIROS/NOAA service.

The *WSH* provides some advice on crystal filter selection. If the receiver also uses a 455-kHz ceramic filter, you may have a problem since wider ceramic filters at this i-f frequency are harder to come by. I have had good success in some instances by simply replacing the 455-kHz filter with a small coupling capacitor.

Receiver Selection

In selecting a receiver, either off the shelf or for modification, the bandwidth factor should be foremost in your mind. In the sections that follow, I will outline some general strategies for receiver selection and modification. You should consult the *WSH* for more detailed coverage, including the addresses of the various vendors that will be noted.

Commercial Satellite Receivers

Obviously, the simplest approach is to buy a receiver designed for satellite reception. Models are available from vendors such as METSAT Products and Vanguard Labs. The most inexpensive options are crystal-controlled, and the crystal investment is quite modest since you will rarely want more than about four frequencies, unless you want to search for experimental Soviet spacecraft.

Kits

Your most economical option is to build a receiver from a kit. The number of VHF FM receiver kits available is now quite limited, but

Date	01 November 1986	
Spacecraft	NOAA-6	NOAA-9
Orbit Number	38192	9714
Eq. Crossing Time (UTC)	0105.71	0106.21
Longitude Asc. Node (Deg. W.)	99.23	152.74
Nodal Period (Min.)	101.127	102.0638
Frequency (MHz)	137.50	137.62

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data.

fortunately Hamtronics still has several models, one of which is specifically broadbanded for satellite use. Such receivers are typically crystal-controlled.

Converter/Communications Receiver

Another possibility, not often considered, is to use a converter ahead of a communications receiver equipped with an optional FM i-f. If the FM option will provide sufficient bandwidth or can be modified, this approach can be very effective. The receiver will be tunable, but the high accuracy of most HF receiver vfo's will not present a problem in monitoring a specific frequency. You could modify a standard two-meter converter working into a 10-meter i-f (add a new LO crystal and retune), or you could contact companies like Spectrum International and have them modify a converter for you. Again, double-check the FM bandwidth specs; if the receiver is too narrow, you will get a strong but unusable signal!

Scanners

Now we come to the subject of scanner receivers! These beasts come in three general configurations: first-generation crystal-controlled units, programmable units covering the public-service bands, and wide-coverage programmable units.

Before I discuss each category, a few general guidelines are in order. First, if you are going to buy a new unit, insist on seeing a schematic. In the case of the Radio Shack receivers, such a schematic is usually in the manual, although you may need a magnifying glass to read it. The purpose of this step is to look at where the filters are located in the circuit. If you buy a used scanner, see if you can get a Sams Photofact sheet on it from your local electronics distributor.

Try to stick with units that employ standard i-f frequencies (10.7 MHz and 455 kHz), as you will have more luck in locating replacement filters to widen the bandwidth. I personally would avoid receivers that use other i-f frequencies. Ideally, try to get the dealer to open the case for you. Most will not, but try anyway. This will give you a chance to assess the mechanical aspects of filter replacement.

Crystal-controlled scanners are by far the simplest to work with. Generally the board layouts are more open, making it easier to get at the filters, and the VHF HI band (144–174 MHz) can usually be retuned to cover 137 MHz. Do not expect spectacular sensitivity since the front ends are designed for broadbanded service. But don't worry about it either since an external preamp will be needed in any case.

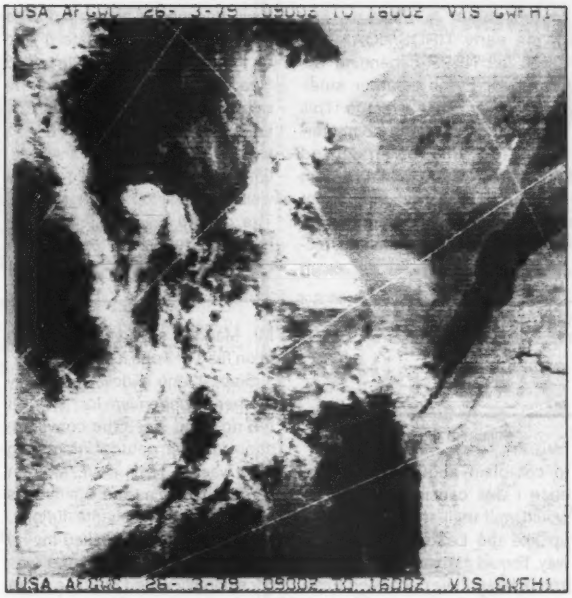

Photo A. Computer-formatted image of the Red Sea area, which was retransmitted through the GOES E spacecraft at 1691 MHz.

Programmable scanners designed strictly for public-service use present two problems. The first involves the tuning range. Most scanners are strictly limited to 144–174 MHz in the VHF HI range, and entering a 137-MHz satellite frequency will get you an error message of some sort. Two solutions are possible—setting the receiver on a frequency that provides high side injection for a satellite frequency and retuning the rf stages to peak at 137 MHz, or the use of a converter to convert the 137–138-MHz satellite band to a frequency range in the VHF LO band (usually 30–50 MHz).

The second problem, which concerns bandwidth, is preferred, but both options are described in the *WSH*. The PC boards of these receivers tend to be quite tight in layout, and actually getting at and replacing filters can be a problem. The degree of miniaturization makes it imperative to locate equally small replacement filters, and this can present difficulties. Here is where examining the circuit and looking into the unit can pay dividends prior to purchase!

The most impressive scanners of all are the wide-coverage units that represent the new generation of scanning receivers. A unit like the Regency MX5000, for example, will tune directly from 25 to 550 MHz in 5-kHz steps, features programming of AM, narrowband FM, and wideband FM for any channel, and has 20 memory channels with all sorts of fancy search options. A receiver of this sort looks ideal since there are no tuning problems and the wideband FM mode, designed for TV sound and FM broadcast use, is certainly wide enough for the satellite signal. Unfortunately, the wideband mode is *very* wide, resulting in a severe degradation of the signal-to-noise ratio (S/N).

A GaAsFET preamp at the VHF antenna will usually minimize noise and maximize signal to the point where a receiver of this sort is useful for polar orbit service, but geostationary WEFAX use presents a problem. Even a GaAsFET preamp for 1691 is significantly noisier than a unit for 137 MHz, and the only solution for boosting the signal without introducing more receiver noise is higher antenna gain.

You will have relatively poor results in trying to use a small (1.2-meter/4-foot) dish with such a receiver even though it delivers a satisfactory signal when used with a 30–40-kHz-bandwidth receiver. The system will work if you use a GaAsFET preamp and a larger (3-meter/10-foot) antenna such as a TVRO dish. But all of this adds to the expense of your system, not to mention the required antenna space. All such problems would disappear if the narrowband FM filters could be replaced with 30–40-kHz units, but the circuit board of a receiver like the MX5000 is packed to the limit with the smallest components you will see outside of an IC. I have no intention of attempting surgery on mine and I am usually quite casual about such modifications!

Receiver Modifications

Regardless of what approach you take to the station receiver, a few additional mods will be useful. The first concerns power supplies. A *very* well-regulated 12-V supply should be used. Scanner ac supplies almost always have an unacceptable hum level. You may not notice it on voice, but it *will* show up on pictures.

A second desirable modification is to provide a constant peak-amplitude audio tap from the receiver to your display system and tape recorder. This makes the video drive level independent of the receiver audio gain control and is quite handy. The easiest way to accomplish this is simply to tap off the top of the volume control (point furthest from ground) using a 0.1-uF disc or mylar capacitor, and then bring the line out to a phono jack at the rear of the receiver.

Trying It Out

Preliminary checks on the receiver can be made with a vertical quarter-wave antenna (51 cm/20 inches) connected directly to the antenna jack. With such a setup, you should be able to hear both TIROS/NOAA and Soviet METEOR spacecraft clearly during the best parts of a good pass. There will probably be considerable fading and noise, but you *will* hear the birds. For operational service, I would recommend the "Satellite Zapper" described in the *WSH*, preferably with a Vanguard Labs JFET preamp at the antenna or, better still, one of the newer GaAsFET units.

For the optimum in low-budget service, you can always clip a battery-operated receiver to your belt and hook up a 3–5 element two-meter beam. You can then stand in the backyard or on the roof and manually track the bird while piping the audio back to the station for recording. This approach is crude but extremely effective. You probably won't need a pre-

amp, given the fact that you have only a very short line to the antenna (a meter or so), and you can move the small antenna easily, rotating it to optimize polarization while monitoring the speaker or using a set of headphones. The neighbors will get a kick out of it, but it does work!

Picture of the Month

This little gem dates back to March, 1979. A failure of one of the early TIROS/NOAA satellites left NESS depending upon an Air Force weather satellite for polar orbit coverage. This particular image was computer-formatted and retransmitted through the GOES E spacecraft at 1691 MHz. To get the correct geographic perspective (N to the top), you should rotate the picture 90° to the right, although I will describe it as printed. The picture covers the eastern end of the Mediterranean. The Red Sea is very prominent on the right side, and the Nile River and Lake Nassar (behind the Aswan High Dam) are visible below it. One end of the Caspian Sea is visible at the top of the picture. The picture was printed on the facsimile recorder described in the *WSH*.

Next Month

Next month I will discuss some basic audio processing of the satellite signal from the receiver. This will be useful no matter what kind of display you will be using.

The *WSH* refers to the Third Edition of the *Weather Satellite Handbook*, available directly from the author for $12.50 postpaid in the United States and Canada and $14 elsewhere in the world.■

FUN!

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John Edwards KI2U
PO Box 73
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TVI TROUBLE

Ol' Benjamin Franklin has always been a sort of hero of mine. When Ben wasn't over in Paris teaching the local female nobility how to French kiss, he was back home in Philadelphia devising witticisms. One of Dr. Franklin's all-time best sayings is "Nothing is certain in life but death and taxes," or something like that.

Ben obviously wasn't a ham, for if he were an advocate of the wireless arts, he would have known that television interference (TVI) is also one of life's certainties. Ben was born before TV was invented, so I guess we can forgive him for the omission.

Over the years I suppose I've generated just about every sort of interference that can be inflicted on a boob tube. I take pride in running a clean station, but when you live in New York City and have dozens of television antennas within a cat's whisker of your tribander, TVI is just impossible to avoid. I've gone through dozens of low-pass filters, and have given away enough high-pass filters to propel one major manufacturer of such devices onto the Fortune 500.

One year, I even pulled a Santa Claus routine. I dressed up like St. Nick, got a big brown sack, and handed out high-pass filters to the neighbors as if they were peppermint canes.

"Ho, ho, ho, little boy. MERRRRY CHRISTMAS. Here's a high-pass filter."

"Gee! Thanks, Santa. But I was hoping for an HW-101."

"Ho, ho, ho. Get lost, you little punk."

When the neighbors continued to complain about the interference I was causing, I thought I would wait until spring and dress up like the Easter Bunny. That way, I could carry additional filters from a beautifully decorated Easter basket. I thought better of the idea, however, figuring that two filters wouldn't be much more effective than one. Anyway, I don't look good in a bunny suit.

When I think about TVI, two stories immediately come to mind. The first is about the time I got a QSL card from a TV DXer in Dallas who said I was S9 +40 on channel 2 during a six-meter band opening. The more interesting story, however, concerns one of my first run-ins with an irate neighbor.

My TVI problems go back to the days before I was even a ham. In 1968 I was a CBer. In the golden days before CB hookers, 18-wheeled good buddies, and pinheads with affected southern drawls, the Citizens Band could be a lot of fun, even in a big city like New York. The bands were fairly empty, the chatter tended to be a lot more interesting than most ham QSOs, the equipment was cheap, and you didn't have to pass a code test. I was 14 and CB was a better way to BS with friends than to hang around the local candy store.

So, most evenings would find me in contact with my CB buddies, Morgan (Phantom), Jon (Willow), and Smitty, a mature 17-year-old who didn't need a CB handle and was sure his hypertension would let him beat the draft.

I was just telling Jon why I felt the "new" Nixon would beat the "old" Humphrey when my mother knocked. She opened my bedroom door a crack and said, "The neighbors are complaining again. Mr. Madden says you're coming in on his TV. Tone it down."

Since "tone it down" was my mother's euphemism for "shut off the rig" and since the conversation was just getting interesting (Jon was an HHH man, Morgan favored Wallace, and Smitty was an anarchist), I became furious. As it was, I had de-peaked my rig to about 100 milliwatts and was occasionally wiped out by a pizza delivery service located in a neighboring county.

"Tell Mr. Madden I'm coming over to talk to him, Mom," I shouted through the door. Jon, who had experienced TVI problems of his own, volunteered to come over to give moral support.

"The two of us will be a TVI committee, just like they're always writing about in *QST*," said Jon.

This wasn't my first encounter with Mr. Madden. He was a tough customer whom I had faced before. What made talking to Mr. Madden all the more difficult was the fact that he was stinking drunk all of the time. I mean, really stinking drunk. You could smell the guy a mile away. You could ignite his breath, and his general body odor wasn't the most pleasant either.

There was another thing about Mr. Madden: He was red. Not just a red-neck (although it was) or a redhead (although he did have red hair). I mean the guy's skin color was red. Beet red. The sort of red that made you think his eyeballs were going to pop out at any minute and spatter you with blood. Weird. Drunk and weird and red.

Still, he was a neighbor, and the FCC and ARRL both agreed that you should treat your neighbors courteously. Only I never remembered seeing anyone like Mr. Madden in any ARRL training film.

So, about a half an hour later, Jon and I knocked on Mr. Madden's door.

"Whooz dere?" said a wobbly voice from the other side.

"John Edwards," I replied. "You complained that I was interfering with your television."

The door opened a little, closed a little, and opened a little further. Mr. Madden was having trouble mastering the intricacies of portal operation.

"Ohhhh yezzzz. You. You'vvvv been coming over acrozzz my teeveee," he managed to get out. Like a true drunk, it was taking some time for his brain to comprehend and act upon the situation. Eventually, however, he realized that I was the foe who was interfering with the broadcasts of "The Flintstones" and he got angry, very angry.

"Nowww youuu loook here," he stammered. "I've taken jussst about all I'm goin' to, youu creep. Either you turn off that radio or I'mmm going to pop you."

Yipe! Fisticuffs! Being a devout coward, I pushed Jon in front of me.

"Say something, Jon," I said.

Jon, who had an uncanny knack of sizing up a situation instantly, said, "Sir, you are drunk."

Mr. Madden didn't say a word, he just hauled back and tried to push Jon's nose against his tonsils. Fortunately, since Mr. Madden was indeed drunk, he missed and splattered his knuckles into the door jamb.

Jon and I ran. We weren't going to wait for Mr. Madden to take a second swing.

Later that evening my father paid a visit to Mr. Madden. I don't remember if he took a shield, a suit of armor, or any hand grenades along. My father, however, was a British soldier during World War II and knew how to take care of himself.

"Son," said my father, "can that radio of yours transmit pictures?"

"No," I replied. "It doesn't make a very good helicopter, either. Why the stupid question?"

"Well, you see, when Mr. Madden claimed that you were com-

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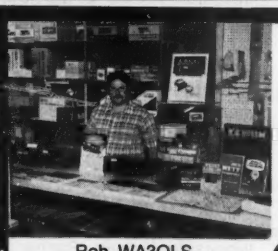

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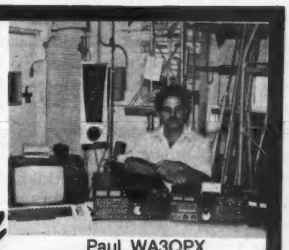

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ing in on his TV, he really meant coming in—picture and all. In fact, he said he's seen you on 'The Carol Burnett Show' and 'Gomer Pyle.' "

What do you say to something like that? My father knew what to say. "I told him to complain to the FCC," my father reported. Good old fatherly common sense.

I don't know if Mr. Madden ever got around to writing his letter. The FCC never contacted me, and shortly after this unfortunate episode, Madden, his wife, and the two little Maddenettes moved out in the middle of the night. We never heard from them again, thank heavens.

Which just leads me to think, were my nightly TV appearances merely the result of an alcohol-ridden brain or were they a new, hitherto unreported type of TVI? Or, as Jon suggested, perhaps it had something to do with alien beings, UFOs, and the Bermuda Triangle.

Oh, well. I've always liked Rod Serling nearly as much as Ben Franklin. And, for some reason, my rig never interfered with the "Twilight Zone."■

QRP

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Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

RULES OF TEN

"Hams never build anymore!" That seems to be the battle cry. Well, if it were not for the AMers, packet people, and us QRP types, it might be ham radio's swan song. That's not to say others don't build; it's just that these groups seem to be soldering up something all the time.

At the Dayton Hamvention, people stand in line just to buy parts. I just don't believe that all those parts will end up as plastic paperweights. So equipment building still has a very strong foothold in ham radio. But Dayton happens only once a year. How do you get all the small parts needed for your next project? Well, there are always more hamfests, but no guarantee that what you'll need will be available. So, what to do? Without a doubt, mail-ordering parts is the way of building in the 1980s. It's a buyer's market, but also, buyers beware! I have a system that I call "Mike's Rules of Ten."

Sometime around 1975, there was a ham radio store that was doing some very bad mail-order business. One magazine took it upon itself to call attention to the problem. That magazine was *73*. There was a warning to new Novices seeking new equipment and, of course, to the parts buyers. What was the company? Trigger Electronics. Even with all the news about the dealings with Trigger, a lot of money was lost due to fraud. Yes, even I got bit, but using my Rules of Ten sure saved my money supply.

OK, just what are these rules of ten? Quite simply, this. When dealing for small parts with a new supplier, order only whatever is the minimum-order amount. This normally is about 10 bucks. When ordering small parts, like transistors, diodes, and the like, order in units of ten. This will save you money—sometimes as much as 30 cents on each part. Then wait ten days (working days) for the order. Using this method, I lost only 10 dollars to Trigger. Yes, I, too, sent copies of my cancelled check to the infamous "Miss Dolly," and several phone calls later was still without my order. So I lost 10 bucks, but it could have been much worse.

Now that my Rules of Ten are common knowledge, what is the best mail-order house and what's the worst? Well, I'm going to stick my neck out on this one. I have made up a list of some of the people I have done business with. Since these are only my opinions, don't send hate mail to *73* but to me. Perhaps someone may have some bad tales to tell about one of the vendors that I like. Also, if you have had good service from a parts vendor, send me the company name and ordering requirements. I would like to expand the list. Meanwhile, here is what I have now, with each vendor rated on a one-to-ten scale, with ten being the best, of course. Again, these are only my opinions.

First on my list is All Electronics Corp. While they have several walk-in stores, all mail orders should go to PO Box 20406, Los Angeles CA 90006. They have a 10-dollar minimum for orders and will take plastic money but no CODs. They sell surplus goodies, new small parts, wire, switches, etc. They have a fine catalog that's free; send for it. They also have very fast service, so they get a 7 on my scale.

Back in 1974, a vendor started to show up in this magazine. Its ad style is still copied today. At that time it was called "James Electronics." Today we know them as Jameco (1355 Shoreway Road, Belmont CA 94002). Primarily selling IC chips and computer parts and accessories, they have become THE source for components. While the minimum order is now 20 dollars, they do accept plastic money. A new catalog costs a buck. A top-rate vendor, they get a 10.

What Jameco is to ICs, Circuit Specialist Co. is to small rf parts. A free catalog may be had by writing to PO Box 3047, Scottsdale AZ 85257. Here is a QRP builder's dream come true. Aside from the usual offerings of transistors and IC chips, Circuit Specialist also offers a vast supply of rf chokes, chassis, PC-mount air-variable capacitors, and meters, just to name a few items. But perhaps the best news, there is no minimum order amount when a check or money order accompanies the order. Yes, they do take plastic money but then there is a 15-dollar minimum. A super vendor, they get a 10.

I can't think where you might be located without one of these stores nearby—Radio Shack. They are one of the very few places left where you can walk in and get some parts. The only trouble is that they may have discontinued the part or simply are out of it. Their prices may be a bit out of line, but on a late Saturday night when you really need that one part to finish up your project, you'll pay the price. Get to know the people who work at your local Shack. They will sometimes alert you to possible advance sales on the parts. Given all of this, the old "Shack" gets a 5.

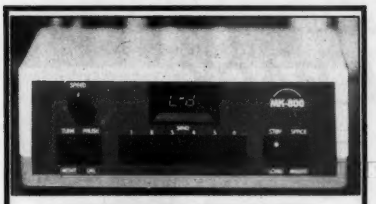
JDR Microdevices, 1224 S. Bascom Avenue, San Jose CA 95128, is a clone of Jameco. Not connected in any way, their ads look very similar. Computer parts, integrated circuits for the hobbyist, and those hard-to-find computer chips comprise the bulk of JDR's business. A 10-dollar minimum order is needed. Plastic money is also fine to use. They don't have a catalog proper, but advertise monthly in magazines. A very fine vendor, fast service, and friendly people, they rate a 9.

Mouser Electronics, 11433 Woodside Avenue, Santee CA 92071, reminds me of the old Allied Electronics. Their catalog looks very much the same, only smaller. They sell everything from soup to nuts. It's very unlikely that you can't find what you want in the catalog, which is free. While I think the prices are not the best, the quality is. On that remark, they get an 8.

There is one place many of us don't even bother to look: the old junk box. The photo shows a 40-meter transceiver I built from two sources—Radio Shack and the junk box. It sports vfo frequency control and has an output of about 12 Watts. (If enough interest is expressed, I will print up the plans.)

Looks like I'm about to run out of space. In my next column I'll look at some more parts vendors and discuss how to buy parts and keep a good stock of the most needed QRP goodies.■

A QRP transceiver built with Radio Shack parts and a well-stocked junk box.



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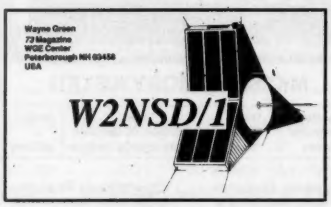

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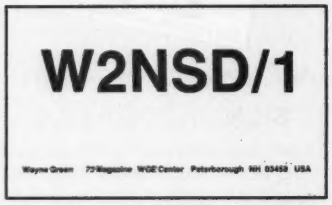

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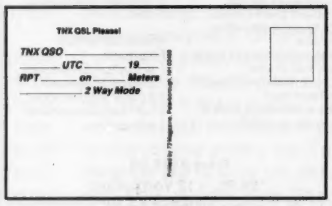

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In our continuing effort to present the best in amateur radio features and columns, we've decided to go directly to the source—you, the reader. Articles and columns are assigned Feedback numbers, which appear on each article/column and are also listed below. These numbers correspond to those on the Feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

"What's in it for me?" comes the cry from our faithful readers. Besides the knowledge that you're helping us find out what you like (and don't like), we'll draw one Feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Reader Service card, the Product Report card, and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

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Most of my previous packet columns have had some sort of theme, or at least they've been limited to one or two topics. This month, I'll dig into the bit bucket and pull out some short subjects, mostly in response to mail received here at NK6K.

First, the nocturnal habits of the West Coast *packeteerius rattus*. I'm a late-to-bed, late-to-rise type. I roll out of bed around 9 a.m. and sack out around 2 a.m., after "Late Night with David Letterman." I also work at home. Therefore, people who call me on the phone at 6:30 a.m. West Coast time hoping to "get me before I go to work" usually don't get a coherent answer to whatever question they might have had. Note also that there is a three-hour difference between Redondo Beach and the East Coast, not two.

Since I don't have a "company phone" to use, all returned phone calls cost real money. I return far more than I should, but I'm trying to cut down. To get the fastest, most coherent response to a question, send it to NK6K-2 via the packet-forwarding system. Unless I'm out of town, this usually gets a same-day response. People not yet on packet are welcome to use paper mail, but that's too easy to stack up and hide away, so a fast answer via paper is unusual. An SASE is always appreciated.

Portable Packet

Chip McCoy WB9OZX wrote in to ask about the portable packet system pictured on page 30 of the August issue. His question is "What additional software is required to use the TRS-80 Model 100 as a packet terminal?" The answer is "none." The Model 100 has a built-in terminal program called TELCOM. Most of the other lap-top computers have a similar program. For the Model 100, start the TELCOM program and enter the following command: STAT 57I1E. Then say TERM. This should start you talking to the DB-25 serial port at 1200 baud.

Apple BBS

Jon WA2YVL asked about the N6BGW-9 BBS pictured in the August issue. He's looking for a W0RLI-forwarding compatible system that will run on the Apple. Scott Avent N6BGW is running a system that was originally developed by Lynn Taylor WB6UUT. Scott has since added a W0RLI-forwarding receive mode and is working on a forwarding transmit mode. Other than this system, I am unaware of any other W0RLI-compatible system for the Apple. If you have one, please write in and let me know. WA2YVL will be moving to South Freeport, Maine, soon, so look for his BBS up there.

France

Remy Jentges F6ABJ sent in a short report on packet in France. He's been involved in promoting the AX.25 standard and in getting about 250 TNCs up and running. He's also working on getting a WA7MBL system up on VHF. They will have had a packet general assembly meeting in October; packet is showing good growth in France.

Flip-Flop

Earl Morris N8ERO writes to say that he has added another bell and whistle to the add-on connect beepers available from several sources. He's added a flip-flop to the connect light so that the LED stays lit after a connection has finished. This lets him know if anyone has connected, left a message, and disconnected while he was out of the room. He's also added a switch to pull the DTR line on the TNC serial port to ground when he's not around. This forces the TNC to hold on to any data received. Some users have had trouble in the past when they simply turn off their terminal, since the DTR line might float and not inhibit characters from "falling on the floor."

N8ERO also notes that a TNC can be connected directly to a modem, giving packet users access to the phone network, and phone users access to packet. This is an interesting experiment and has some useful applications, but care should be taken when connecting amateur frequencies to a non-amateur medium. If the possibility exists that an unlicensed individual can gain access to an amateur transmitter, a non-automated control operator must be present. If you have implemented procedures, such as passwords, that ensure that the phone caller is licensed and is therefore able to operate your station as a control operator remotely via the phone line, you're in the clear. If you aren't sure of your security, it's best to disable that feature if you are not present and able to act as a control operator.

Note that once traffic that originated from a non-amateur has passed through that first non-automated control operator, it may be automatically repeated through the amateur digital network. This is discussed elsewhere in this column under the topic "Third-Party Traffic."

Newsletters

There are perhaps more packet radio newsletters in the land now than any other "specialty" group, and most other specialty newsletters and magazines include a packet column. This is because packet is still new and growing. If you've been on packet for a week you should have come to know more than 20 other new packeteers in your line of sight. Your local packet club and its newsletter can tell you more about how packet works in your area than a national magazine like this one can, so be sure to support your local group to get both parts of the story.

I'll continue to give you the big picture here. Several packet groups exchange newsletters; this is an excellent idea. I get a copy of several, and they're all very good. The only problem is a lack of steady input, which usually burns out the editor after a few months. I want to thank the crews at NAPRA's *Zero Retries*, the Packeteers of Long Island's *Poli Parrot*, and NEPRA's *PacketEar* for keeping me on the list.

Third-Party Traffic

I still get several queries a month on the topic of third-party traffic: "What is third party in relation to packet?" The most recent inquiry came from KM0M.

The best way to start the discussion is to look at the rule-making action in PR Docket 85-105. Also known as the automatic control docket, it gives complete and unambiguous permission to hams to run automated, unattended digital stations: when transmitting digital communications on frequencies above 50 MHz and while NOT sending third-party traffic.

As the result of several petitions for reconsideration and a petition for Extraordinary Relief filed by the ARRL, the FCC partially (and temporarily) waived the third-party provisions of PR 85-105. That waiver said in part:

"(a) The provisions of Section 97.80(b) and 97.114(b)(4) are waived to permit amateur stations, retransmitting digital packet radio communications (see Section 97.69) on frequencies 50 MHz and above, using the AX.25 (or compatible) protocol, to be operated under automatic control while retransmitting third-party traffic. See Section 97.3(v).

"(b) This waiver applies only to the retransmission of third-party traffic originated at another amateur station which is under local control or remote control. See Section 97.3(m)."

AX.25 is specified by name because it is the protocol in use by 99% or more of all U.S. hams and is therefore the most universally monitorable, and because each frame has a complete ASCII callsign identifying the sender. The FCC wanted to make sure that, during the period of the waiver, hams could continue to:

"...ensure that amateur facilities and frequencies are not used by non-amateurs. Only a person who has demonstrated the proper qualifications may be a control operator of an amateur station. Such control operators screen any third-party traffic to prevent transmissions which are prohibited by Subpart E of the Amateur Rules.... Those prohibitions include, but are not limited to, business communications, secret messages, radiocommunications for unlawful purposes, and radiocommunication with nations which have not assented to third-party traffic."

What does all this mean? Ignoring international traffic for the moment, my interpretation is that third-party traffic may be sent by an amateur station under digital control above 50 MHz as long as the traffic was originated at a station with a live non-automated control operator. Obviously, any BBS messages to be automatically forwarded or packets to be automatically digipeated that are originated by a ham are permitted. Any messages to be automatically forwarded or packets to be automatically digipeated that started from non-hams are permitted as long as a ham is present at the station at which the messages are put into the network. That means that a Red Cross worker can type mes-

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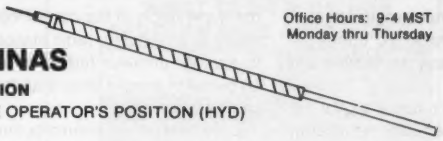

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MRF449,/A	Q	30W	12.50	30.00
MRF450,/A	Q	50W	14.00	31.00
MRF453,/A	Q	60W	15.00	35.00
MRF454,/A	Q	80W	15.00	34.00
MRF455,/A	Q	60W	12.00	28.00
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MRF245	80W	136-174	28.00	65.00
MRF247	75W	136-174	27.00	63.00
MRF607	1.75W	136-174	3.00	—
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MRF644	25W	407-512	24.00	54.00
MRF646	40W	407-512	26.50	59.00
MRF648	60W	407-512	33.00	69.00
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sages into the keyboard of a packet terminal for transmission on the packet network as long as a ham is there to screen the messages. You may not turn your station over to that worker while you hike down to the food tent. You may, however, turn a computer over to a non-ham, who can then store messages on a disk while you are gone. When you return, you can screen the stored messages, and then dump them into a TNC.

The PR 85-105 docket, with waiver, is also clear about what you may not do. You may not:

• Run an unattended station below 50 MHz, no matter what the circumstances. It must have a control operator.

• Use the various digital rules and waivers above or below 50 MHz to send third-party traffic to foreign countries that do not permit such communications.

To summarize yet again and still ignoring international aspects:

1) Anything can be sent on packet above 50 MHz, automated or not, as long as a ham starts it into the network, either directly or as a control operator, and if that ham ensures compliance with all other Part 97 rules regarding permitted and prohibited communications, primarily no secrets and no business.

2) You can't run a digital HF station unattended, no matter what kind of traffic you're sending. Sorry, but those are the rules.

Note that whether or not the messages are third party have been factored out of the above, so we can ignore the question of what is third-party traffic. As long as a live ham is present at the starting point, the rest of the stations in the network can forward the message without reviewing it. The FCC asks that, for the period of the waiver, we carefully monitor packet transmissions and report any abuse of an automated station to the control operator so he can take proper corrective action.

Now for the hard part, international packet. If you don't leave messages for anyone outside of North America or to areas where we haven't signed a third-party agreement, you may skip to the end of this section. Otherwise, we must define third party. Looking at Part 97.3(v), we see:

"Third-party traffic. Amateur radio communications by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator."

Let's look at an unambiguous case first: If NK6K is talking on 20 meters to G3YJO in England, that's legal. If an unlicensed friend of mine, standing in the room, wants to say "hello," that would be third party and not permitted. The friend's hello is not on my behalf, and therefore is not legal.

Now let's look at a tougher case. NK6K is talking to G3YJO through a satellite. At first glance, there are three parties involved, the control operator of NK6K, the control operator of G3YJO, and the control operator of the satellite. Fortunately, 97.417(c) exempts satellites from having control operators. In practice, amateur satellites are usually treated (when counting parties) as lumpy parts of the ionosphere. Therefore, the fact that you have relayed a message through a satellite does not make it "third party." A store-and-forward satellite would be treated in the same way.

Actual third-party traffic—e.g., if a friend wanted to say hello through my radio over the satellite—would still be illegal, unless a specific third-party agreement had been signed between the two countries involved.

We can define an even tougher case. Can a licensed ham send a message on VHF through several unattended digipeaters to a gateway, have it relayed via other VHF gateways to a satellite gateway, have it uplinked to a store-and-forward satellite, and then downlinked to a ham in a country that we don't have a third-party agreement with? Yes. The fact that it is going through a satellite can be ignored, since that does not turn traffic into third-party traffic. Going through automated digital stations does not make it third party. Thus ignoring the relay points, the question is then, is the communication on behalf of anyone other than the originating amateur station and the destination amateur station? In this example, it isn't, so it's OK.

There is one last case that is firmly in the middle of a gray area. What if, in the above example, one of the intermediate relay paths between the originator and the satellite gateway is on HF. Here we can't invoke the PR 85-105 waiver, since it doesn't apply below HF. All I can say is that since the message started with, and on behalf of, a licensed amateur, and it will end up with a licensed amateur, and the intermediate points are simply an automated extension of the ionosphere, it ought to be OK. It is certainly not OK if the communication is not on the behalf of the control operators at the end points when the countries at the end points haven't signed a third-party agreement. As long as we keep that in mind, we're OK.

Bunk

I've been hearing a lot of talk lately that Wayne doesn't realize the value of packet radio. Well, that's a lot of hooey. On Friday at the September ARRL National Convention in San Diego, the August "all packet" issue of *73* was selling as a back issue for $1. By Saturday, the August issue was selling as a current issue for $3. That should show those rumor mongers. I also understand that Wayne (or a reasonable cardboard facsimile thereof) spent the night enthroned in the DRONK hospitality suite, but I'm still waiting for photo proof on that one.

Kids

I'm short of space here, as always, but I wanted to mention something that happened last weekend at the ARRL National Convention in San Diego. A Youth Forum was held, chaired by astronaut Dr. Tony England WØORE. I was one of the panelists. There were about 150 kids aged 9–15 in the audience. During my pitch, I asked the kids how many of them had a computer at home. Every hand went up. Later in the forum, a mother asked what it would cost to get involved in amateur radio. I then asked how many kids had a disk drive on their computer. Most of the hands went up. I pointed out that the cost of the cheapest TNC and a swap meet, special 2-meter radio is less than the cost of that disk drive. Not all potential young hams fall into this category, but a great many do.

Keep this in mind when pitching amateur radio to the younger crowd. Get a computer into the demo somewhere; it will be a good point of reference for them. Beware, though, one of the little rug rats is likely to tell you something you didn't know about your own computer.

Next month (maybe), the first ever *73* packet poll. See you then.■

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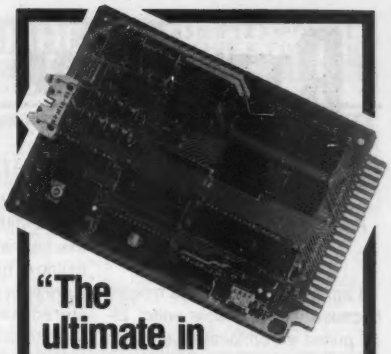

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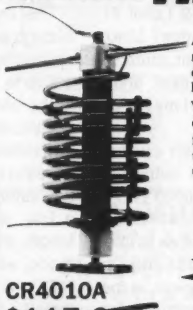

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CoCo BONANZA

I am a bit confused this month because the honorable editor of *73* pulled an editorial string and shifted some dates around. However, if I read things right, this should be published in November, so a Happy Thanksgiving to you all.

In the last column, I promised some goodies for the rather vocal CoCo crowd, and I shall not let you down. By now, I assume most of you have heard about the CoCo 3. Just being announced as this column is being written, the Tandy Color Computer 3 promises to present a serious challenge to many of the newer computers on the market.

A look at some of the listed features should be enough to boggle the mind. How about 640 x 192 pixel graphics in four colors, or 340 x 192 pixel graphics in 16 colors from a palette of 64; or RAM expandable from a supplied 128K up to 512K; or a built-in 80-character by 24-line display; or television (rf), composite video, and RGB monitor outputs; or even the ability to run OS-9 Level II? And all this for less than $240, according to my current sources! It sounds like quite a deal, and I for one can't wait to get my hands on one!

For those of us with current CoCos, however, the battle cry has been "give me a good RTTY program" for longer than I can remember. Well, folks, listen to this.

Ken E. Crowston VE5BBP, in Shellbrook, Saskatchewan, is the North American distributor for Grosvenor Software. This British line offers programs to put the Color Computer onto CW, RTTY, and AMTOR, and all for a rather modest price. Let me tell you a bit about the programs first.

The Morse program, BMKCW, functions as a full-service CW transceiver, kind of a glass Teletype™ for CW. The speed range, applicable to both sending and receiving, is from you've-got-to-be-kidding slow to about 200 wpm. Transmit speed is set up at the start and stays constant independent of received speed. Receive speed tracking is automatic and can be set to respond to machine or hand-sent code. A sidetone is even available to listen to through the television speaker to aid in tuning or monitoring. Want more? More than 20K of received data is stored and can be reviewed. Push-to-talk is directly controlled from the keyboard. A transmit type-ahead buffer is maintained, with editing of characters possible before transmission. And, not to forget, the ability to save and retrieve pages of text to and from disk.

No great surprise, the RTTY program, BMKRTTY, looks and feels very similar to its sibling program. This is, however, a very well put together program. RTTY may be received through an external terminal unit or with the computer directly doing the decoding of received audio. The computer is programmed to handle standard 170-Hz, 425-Hz, and 850-Hz shifts, without the need for an external demodulator. Murray baud rates of 45 (amateur standard 60 wpm), as well as 50, 75, and 100 are supported. ASCII data exchange is also supported at 110, 300, and 1200 baud. Some systems may even handle 2400 baud, they tell me.

The rest of the features are enough to make your head spin! A split-screen, type-ahead buffer supports some 4,000 characters in the transmit buffer. About 19K of data, close to an hour's worth of transmission, can be stored and saved to disk. Unshift on space, or not; automatic CR/LF at the end of a line, with programmable line length; even a receive "standby" mode, which monitors for a valid RTTY signal—kind of like autostart—are all provided. Oh, and let's not forget built-in RY tests, and QUICK BROWN FOX keys, as well as a 31-character scratchpad memory to enter the other guy's name and call into.

Both the CW and RTTY programs include identification keys, by the way, which transmit your call on CW, RTTY, or both on command. Your call comes pre-programmed when you buy the program, and can be changed only by the dealer upon a nominal payment with suitable documentation. This is a novel method of copy protection, in that you are free to make as many copies as you like, for your own use, but give one to a friend, and he is stuck with your ID!

The third member of this set is BMKAMTOR, an AMTOR transceive program for the Color Computer. By now, the features of this program should be fairly familiar. Split screen, user memories, disk save and recall, transmitter control, and other RTTY-like features are available. While this program does require a bit more hardware, including a 1-kHz external clock, the benefits to be gained are also a bit more. A 24-hour clock is displayed on the screen and is transmittable. Several modes of AMTOR transmission are supported, including FEC, ARQ, and listen to ARQ. And yes, CW identification is built in as well.

Now, as to the bottom line, I do hope you are sitting down for this. In Canadian dollars, the CW program sells for $28, the RTTY program for $28, and the AMTOR program for $45. Remember, these are Canadian dollars, so a conversion will be required to U.S. dollars, and the prices do not include postage and handling. So why not drop Ken a line, at Crowston Enterprises, 307-111 Wedge Road, Saskatoon, Saskatchewan S7L 6S8, Canada, and ask for a catalog and price list. RTTY software has been scarce, so let Ken hear from you, and tell him that you read about it here in RTTY Loop!

Galfo Update

One of the things that never ceases to amaze me is the ability of you readers to come forth with information to help others. In what may be a continuing saga of Apple communications, the tale of the Galfo program goes on. Jim Marold WB2TZK/7J1ABK/KA2JM/NNN0IFL writes with his story of Apple programs. He says:

"The Galfo program is actually called HAM.M communications disk. In addition to the RTTY/CW program capability, it has several other programs included. The main point is it runs in Integer Basic. The old Apple][ran Integer Basic as a matter of course, but the II+ requires Integer Basic be loaded into the language (16K expansion card in slot 0). If that's not available, there is an Applesoft program that emulates Integer Basic. Run that prior to running an Integer Basic program; as long as there is enough room in memory for both programs, you're up and running. The program was written by Dr. C. H. Galfo. There may also be a SSTV program on the disk.

"The program is certainly user friendly. On booting, it informs you of how much space is allocated to the receive and transmit buffers. This space can be shifted to put more in receive if desired. It then asks whether you want Morse, Baudot, or ASCII. If Baudot is selected, it then asks at what baud rate. The next question is word or character transmission, then the fill character (blank, LTRS, none). The program then goes into the receive mode with 2/3 of the screen for receive and 1/3 for transmit. There is a single status line with a tuning star. Calling various control keys allows putting either buffer on disk or getting a file from disk, changing speeds, changing modes, etc.

"The program handles machine CW very well compared to [another program I have used]. I monitor 10.415 MHz for Ursigrams (solar activity reports), which is machine-keyed at 20 wpm by JJD/JJD2 in Tokyo. The HAM.M program prints the CW as it's sent, and the wpm can vary without taking hits. If it drifts too far off, a simple Control-R puts it back on the chosen speed. The [other] program doesn't recognize the spaces in CW and runs everything together. When your data is five character number groups, reading [the other program's output] can get tedious. HAM.M looks at the game I/O port for a specific configuration. You must modify the software or your TU to match. [The other program] allows you to configure the software as part of the start-up procedure. Since I use a homemade TU, I had more problems getting [the other program] to look at the right pins than HAM.M."

I appreciate the information, Jim, and I am sure that the Apple users who frequent this corner of *73* second the thoughts.

Audience Participation

Have you noticed the "new look" of *73*? For those of you who may have just arrived, the changes are under the auspices of Wayne Green W2NSD/1, who founded this magazine and serves as a driving force behind the vanguard of amateur radio. Among all the things the new *73* gives you, it asks for only one thing in return. In each issue of *73* is a Feedback card. Tear it out, fill it out, and send it in. All it will cost you is a stamp. Tell Wayne what

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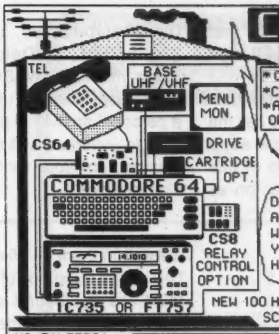

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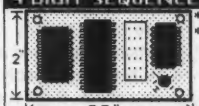

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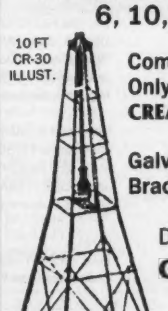

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you think of the various articles and columns (RTTY Loop is "Great," right?), add your comments, and send it in. The staff assures me that the cards are read and that their content does make a difference. And, you stand to win a year's worth of *73* if your card is pulled from the hat! Go ahead, do it now; I'll wait right here.

Are you back? Thanks. Now, remember that if you want to ask me a question, you can drop me a line at the address at the top of this column or send me E-mail on either CompuServe, using ppn 75036,2501, or Delphi, using username MARCWA3AJR. If you want a copy of the list of reprints or a personal answer in the mail, be sure to include a self-addressed, stamped envelope for Postal Service inquiries.

I have a stack of mail here to go through for next month. They tell me that contesting is the theme. Somehow that seems appropriate—because every month I have a contest, going through the mail you've sent me, attention RTTY Loop!■

ATV

Number 15 on your Feedback card

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

ATV continues to fascinate many amateurs who have not yet experienced the thrill of being able to send their own video pictures. I've always been fascinated to be able to work ZS6BTD, ZS6AO, I3XQW, VO1BL, 8P6NC, ZL1BLV, HR2HH, FM7CD, ZL2FR, LU4EGO, OT6DI, OZ4IP, 5N0DOG, OH5RM, G3WW, and VP9IH on phone as well as SSTV. The nearby DX crowd around the 14.230-MHz SSTV operating frequency always manages to disrespectfully QRM SSTVers because they don't realize that SSTVers have the right to operate those shrilling tones anywhere in the phone bands. SSTVers purposely huddle together around one little area, though, for companionship and so as not to QRM others. It irritates DXers, I think, to have the SSTV crowd work rare ones right along with them on 15 and 20. On UHF FSTV hundreds of local amateurs are spellbound at ATV demos when they see the quality of full-color FSTV being sent on 420–440 MHz.

ATV seems to be the mode that is last on everyone's list of things to try out—but it is the most fun to operate. Why's that? I don't know. What could be simpler than a small UHF antenna, some coax, a tiny black box (downconverter), and a hookup to a TV set that probably is already in your shack. But if you just mention "TV" or "video," it scares the heck out of the people who think they have to be broadcast engineers to understand and operate the mode. Heck, I'm the editor/publisher of *The Spec-Com Journal* and I don't understand just how the video picture works. I know about lines and pixels and something called sync, but that's about it. Don't let the fact that you know nothing about ATV stop you from getting some gear and getting on. The mode needs your participation, and the work you put into it will be worth it because you'll gain a whole new bunch of friends.

Canada		New Hampshire	M. R. Natola WA1EZE
Alberta	Abe Mackay VE6AMU	Rhode Island	Open
British Columbia	Allan Tucker VE4ADQ	Vermont	E. J. Nowas N1QG
Manitoba	Open	Western Massachusetts	Mel Dunbrack W1BHD
Maritime-Nfld.	Lewis Roberts VO1BL	**Northwestern**	
Ontario	Lloyd Morgan	Alaska	Frederick E. Wirth, Jr. KL7FAP
Quebec	D'Arcy Brownrigg	Idaho	Albert Hale N7AL
Saskatchewan	Open	Montana	Carter S. Emert KA7CJZ
Atlantic		Oregon	Open
Delaware	Elmer R. Boyer W3YAH	Washington	Robert Fielding W7BGP
Eastern Pennsylvania	John Shaffer W3SST	**Pacific**	
Maryland-DC	Bruce Brown WA9VGK/4	East Bay	Open
Southern New Jersey	Open	Nevada	Open
Western New York	Ralph Janowsky W2RPO	Pacific	Stephen S. Barnes KH6SB
Western Pennsylvania	Richard Davies K3SPI	Sacramento Valley	F. A. Burgess W6IEV
Central		San Francisco	Gerard Wilson WA6RDA
Illinois	Henry Ruh KB9FO	San Joaquin Valley	Open
Indiana	Don Miller W9NTP	Santa Clara Valley	Clay Abrams K6AEP
Wisconsin	Dean Andrewjecski AD9W	**Roanoke**	
Dakota		North Carolina	Herman Perkins W4TVQ
Minnesota	Ronald P. Hines WA9NJR	South Carolina	Hap Griffin, Jr. WA4UMU
North Dakota	Pius Klein W8HJU	Virginia	Bruce Brown WA9GVK/4
South Dakota	Open	West Virginia	Open
Delta		**Rocky Mountain**	
Arkansas	John J. Okopinski W5RET	Colorado	Terry W. Thero WB0OMN
Louisiana	Phillip Spencer W5LDH	New Mexico	Open
Mississippi	James P. Allen W5LWS	Utah	Douglas R. Cook WB7SOW
Tennessee	Ed Draughn WA4KMG	Wyoming	George Schueller WA0GIL
Great Lakes		**Southeastern**	
Kentucky	Clyde Miller WB4AOH	Alabama	Douglas Hall KD4EM
Michigan	Allan L. Smith WB8YOB	Georgia	David A. Carter WA4VHP
Ohio	Dave Morris WB8PJZ	Northern Florida	Robert Sutter W3SOB
Hudson		Southern Florida	Bob Calvert N4IVB
Eastern New York	Dean Morelli N2DDL	West Indies	Miguel O. Navarro KP4DGW
NYC-Long Island	Open	**Southwestern**	
Northern New Jersey	Ken Barber W2DTC	Arizona	Bill Munsil N7AOU
Midwest		Los Angeles	John Ruckert WB6ZPN
Iowa	Mike Stone WB0QCD	Orange County	M. H. Klos KA8GVY
Kansas	Carl E. Schafer W8EFZ	San Diego	Jack Dobbs WB6AXW
Missouri	Dave Williams WB0ZJP	Santa Barbara	David B. Johnson NF6F
Nebraska	John Gebuhr WB0CMC	**West Gulf**	
New England		Northern Texas	Open
Connecticut	Ronald W. Sizer K1VYU	Oklahoma	Mike Veldman WD0CTA
Eastern Massachusetts	Richard B. Kendall W1JFK	Southern Texas	Andy MacAllister WA5ZIB
Maine	Phil Whitehouse W1GEE		

Table 1. U.S. ATV Society state section manager volunteers. Please include an SASE when corresponding with these managers. Apply to WB0QCD for open positions.

FSTV Groups

One of the big problems in becoming active on FSTV is trying to find out where the nearby UHF operators are sending their pictures, what frequency they might be using on two meters, and what antenna polarization is being used. A lot of that work has been done for you. In 1983 the United States ATV Society was formed. The body was organized into 73 volunteer section manager positions. Although some positions are vacant, most states are well represented. Table 1 lists the USATVS managers. Feel free to contact your area's representative to help you get going on ATV (include an SASE if you write). If you're already active on FSTV, please update these volunteers as to the activity in your area.

Where Are They?

Metrovision (Washington DC area), formerly WR4AAG and now WA9GVK/R, has video out on 426.25. The local two-meter auxiliary audio frequency is 145.070 FM. Metrovision has over 40 ATV operators registered with the USATVS. In *Michigan*, WB8YOB has reported lots of activity. The Arrow repeater near Detroit is on temporary authority by the FCC to operate FSTV until the land-mobile business-band service gets going, but they are working on a 900-MHz system. KB8NR is active in the Flint area and is one of the original old-timers. W3SST reports good activity in the *York, Pennsylvania*, area not too far from the *BRATS* (Baltimore) ATV group. *St. Louis* ATV is alive and

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well with WBØZJP leading a group of ten or so UHFers. They monitor 144.430 FM locally. In the *Davenport, Iowa*, quad-cities area, about 30 FSTVers are on the air DXing simplex and working the fancy horizontally polarized 100-Watt N9CAI ATV/R. Most of the Midwest, including the *Chicago* area, uses 144.340 for a two-meter "talk" channel. The *Minneapolis/St. Paul* ATV group is led by WA9NJR on 147.57 and is full of activity. *California* uses 434.0, with 146.43 for two-meter audio; there are also several repeaters. Write to W6ORG for more information. There is a big ATV group in the *Phoenix* area called the "AAA5 Club" that is led by N7AOU. In the *Calgary, Alberta*, area, about ten ATVers are active (VE6AMU); there are about thirty near *Toronto*.

Photo A. 200-mile FSTV DX received by WBØZJP in St. Louis.

Polarization

Antenna polarization is a nagging problem in some areas. Horizontal polarization is used for FSTV across most of the nation. This allows ATVers to also operate 432 SSB on the same antennas. Vertical polarization is used in California, Florida, Virginia, parts of Indiana (around Indianapolis), and parts of Texas. This allows 440–450 FM to be operated.

There are 60 plus ATV repeaters known to be operating in the country at last count (1982) and they are a mixed bag of polarization. It doesn't really matter which polarization mode is used in your area as long as you find out what the standard is and go with the crowd. Polarization has become quite a controversial subject among ATVers who like to DX. A number of horizontally polarized, omnidirectional antenna designs have been published, with a 7-dB K4NHN rib-caged modified Alford Slot having been successfully demonstrated this year at Dayton by the Cayce/Sumter/Columbia, South Carolina, ATV group.

Surveys show that the English-made Jaybeams and KLM beams are the most popular ATV antennas, followed by K2RIW's antennas and home-brew yagis. Good low-loss coax is very important on UHF frequencies, yet it is always the least-attended-to detail. A good rule of thumb is not to settle for anything less than Belden 8214 or Saxon 8285. Even with a 4.5-dB loss per 100 feet at 400 MHz, you will still lose nearly *half* of your power output and incoming receive on any long runs. The new Belden 9913 is now the hot buy for ATVers, with losses as low as hardline. Beware of 75-Ohm cable TV hardline. I know it is usually free, but you get what you pay for.

Preamps help amplify the received signal quite a bit. Some models can be switched out of line during transmit even at very high power levels. Advanced Receiver Research (Box 1242, Burlington CT 06013; (203)-582-9409) can provide you with some interesting brochures on preamplifiers if you ask for them. For more specific details on UHF antennas and coaxial cable, consult *Everything You Always Wanted To Know About ATV *but were afraid to ask* ($9.95, Spec-Com Publications, PO Box H, Lowden IA 52255).

SSTV Equipment

A few years ago, getting into SSTV meant spending nearly $1,000 to get the latest B/W scan converter, an audio cassette recorder, and a camera. Today you have a choice. You can still put out a lot of money and purchase the latest high-tech color SSTV equipment—Robot Research 1200C, $1,295, 256 pixels across the screen by 240 lines; high-resolution color makes for a beautiful 8-, 12-, 24-, 36-, or 72-second image picture; the unit does all sorts of tricks including automatic tracking and split-screening. (For a four-page color brochure on the system, send an SASE to Robot Research, Inc., 7591 Convoy Court, San Diego CA 92111.) Or you can look around for some older/used equipment, computer software, or interfaces.

Let's think cheap for a minute (not a big mental leap for most of us). Manufacturer-discontinued Robot 400 SSTV scan converters used to cost $795 new. They can still be found "new" at $395 on some dealers' shelves. Used converters can be found at most hamfests for as little as $150 if you barter a bit. These units are B/W, have a good picture resolution of 128 pixels per line by 128 lines, and will store one full picture in memory. (They can be converted to color with 400C board updates.) You simply hook a closed-circuit-(CCTV) or VCR-type camera to the FSTV input and it will convert the "live" picture into a slow-scan one. A simple connection to the audio input of your HF rig's microphone connector is all that is necessary for transmit interfacing. One audio wire runs from your speaker to the back of the Robot 400 for incoming signals.

Transmission picture rate is the former standard of 8 seconds per frame. Contrary to popular belief, there is still a lot of 8-second SSTV being sent. All modern day SSTVers have 8-second compatibility. All you have to do is explain the type of gear you are running and they will switch over to the faster speed format for you. During the Saturday SSTV nets, net controls try to always send an 8-second formatted picture for those still running that type of gear. There have been dozens of modifications to the Robot 400, and Ralph Wilson WBØESF has compiled most of them into a thick booklet called *Robot Mods*. It is available for $11 ppd. from WBØESF at 4011 Clearview Drive, Cedar Falls IA 50613.

If a Robot 400 is still a bit rich for your budget, then look for the older Robot 70 or SBE SSTV Converter gear. This equipment utilizes P7 image burn tubes of green or yellow and must be viewed in a dark corner to be seen correctly. Good pictures can be received and sent on this type of equipment, and the cost is usually under $100 for the whole outfit. Still too rich? How about a "reduced resolution" computer software program to receive and/or send SSTV. Radio Shack Color Computer owners have been watching SSTV pictures for years on a completely interfaceless (other than one audio wire from the receiver) 16K software program called "SLOWSCAN" from Kinney Software. This program has been modified to include just about all the current speed formats being used in SSTV, and it even receives and displays "false coloring." Dick Kinney W8MBD (121 Hampton Road, Donnellsville OH 45319) astounded the Dayton crowd this year with computerized SSTV for the Commodore 64. Unlike the CoCo program, which is receive only, SLOWSCAN III (C-64) receives and transmits by use of an owner-constructed interface card. Dick also has a video digitizer circuit and software that complements the program and construction kit. The C-64 software/kit packages sell for $39.95 each. There is also SSTV computer software for IBMs and Apples.

Clay Abrams K6AEP wrote a ton of software and interface designs for the CoCo for a number of years, but he gave it up when a small band of pirates tried to make some quick cash by selling his work. Clay moved on to the IBM computer, and he has once again developed some high-resolution SSTV and FAX software that will knock your socks off. Write Clay at 1758 Comstock Lane, San Diego CA 95129. Ralph Taggart WB8DQT even came out with a single-chip circuit called a ROM-SCANNER, which stores and sends SSTV pictures. If you missed out on the *Voyager* and space shuttle SSTV pictures from space a couple of years ago, Wayne Harrell WD4LYN (Route 1, Box 185, Sycamore GA 31790) now maintains a unique video and SSTV audio tape program collection and he will make quality duplications for a moderate price. Write him for a catalog.

You see, you can spend $39.95, a couple of hundred dollars, or up to $1,295 to get going on SSTV. The important thing is to get in there and get your feet wet with something.■

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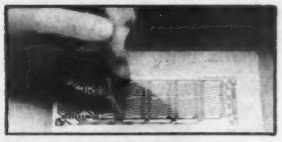

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POLARIZATION

Actually, this all started out innocently enough . . . I was going to mow the lawn . . . really! It's just that every time I go outside to work, I always take a look up the tower and begin to think of new antenna arrays.

An incident that occurred earlier this summer came to mind: I had helped my uncle Ray Putman N2FYC install a new 17-element F9FT yagi at his home in Alexandria Bay, New York. After the job was completed, my wife and I proceeded to our summer home on Wolfe Island, Ontario, about 20 miles upriver near Kingston.

Photo A. The horizontal vs. vertical polarization test range. The 5/8-wave vertical is in the foreground and the KLM beam is in the background. Crescent, VHF/UHF's most famous dog, guards the test setup.

Ray and I initiated successful contacts on 146.550-MHz FM simplex; he was using his beam mounted horizontally on a 10-foot tower, while I employed an old reliable KLM 4-element yagi strapped to one of the roof studs with shock cords—also horizontally polarized. He used a Kenwood TR-7400A, while I was barefoot with an ICOM IC-2AT.

During the course of our first QSO, Ray asked what, if any, difference in signal strength would occur if he changed his antenna to a vertically polarized installation. I was in a position to do just that and within seconds unlashed the shock cords and rotated the KLM 90 degrees. Ray reported a drop of three "units" on the Kenwood scale! If the meter was accurate, these would be 3 S-units, worth about 6 dB apiece.

Of course, even not knowing what those "units" meant (if anything), it was pretty obvious to Ray that my signal had undergone substantial deterioration. And this brings me to why I didn't get the lawn mowed the other day . . .

One of the more common complaints I hear from newcomers to 2-meter SSB who previously operated 2m FM is that "there's no activity" or "I can't hear anyone" or even "all the signals are so weak. How do you make a reliable contact on SSB or CW?"

The problem becomes pretty obvious. In every case, the operators are still using the same old Cushcraft Ringo Ranger or Hustler vertical or KLM J-pole or even a vertically polarized yagi that was being used for FM work! It's not Murphy, but polarization losses that are doing them in—the same principles that allow satellites to transmit two different signals on the same channel by making sure they are polarized 90 degrees apart.

How much difference is there between signals received in the same plane as the receiving antenna and in opposite planes? Assuming ideal conditions with no scatter or reflection of signals, an infinite degree of isolation could be achieved between vertically polarized and horizontally polarized signals occupying the same channel. Since this isn't usually the case for the average ham, the number may be something finite and measurable.

In tests that I have run over the years, casual observation would indicate that as much as 20 dB or so difference is commonplace between stations with similar antennas 90 degrees apart from each other. How about that same operator mentioned earlier with a simple vertical trying to work a station with a simple yagi? To answer this question, I set up a test range in my backyard to see the results, using my KLM and a selection of vertical mobile antennas.

The first setup looked like this: An ICOM IC-2AT was attached through a Bird 43 with 5-Watt slug to a Larsen magnetic-mount antenna, using a 5/8" whip. The antenna rested on an aluminum plate to yield a ground plane. All of this rested on a garbage can atop a wooden stool. Photo A shows this elegant setup. About 40 feet away, I fastened the KLM beam to my tower about 6' above ground in a vertical plane (Photo B). The output from the beam was fed to a Boonton Electronics Model 92 rf millivoltmeter with 50-0hm terminated probe (Photo C).

I used the wattmeter solely to establish the presence of a stable signal from the 2AT. After keying the hand-held with a switch into transmit, I logged the readings from the millivoltmeter. The reading was +2 dBm with the hand-held running 1 Watt output. Next, I turned the KLM 90 degrees and remounted the clamps (Photo D). After careful aiming and peaking, I logged a reading of −17 dBm, a net loss of 15 dBm of signal—over 2 S-units. Pretty substantial!

Next, I switched to a quarter-wave Larsen radiator (Photo E). With both antennas in the vertical mode and running 1 Watt output, I logged a reading of −1 dBm on the meter. Rotating the KLM beam horizontally then resulted in a reading of −14 dBm, a net loss of 13 dBm of signal. (Incidentally, this test also showed, in a crude fashion, that the 5/8-wave antenna exhibited gain of about 3 dB over the quarter wave.)

What if I used an improper radiator? A 220-MHz quarter-wave radiator—not resonant at 2 meters—was connected. In the vertical mode, I noted a reading of −7 dBm. When the KLM was rotated

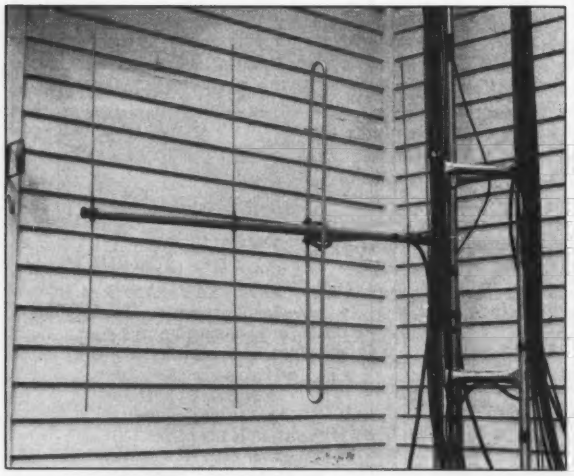

Photo B. The four-element KLM beam is connected to the tower and is vertically polarized. Output from the KLM beam is fed to an rf millivoltmeter.

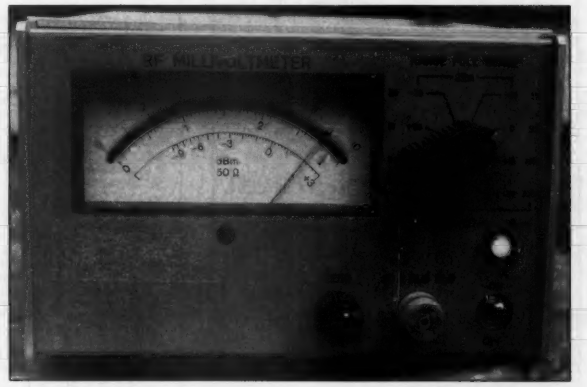

Photo C. Rf millivoltmeter measuring output from the 5/8-wave Larsen antenna in a vertical plane.

90 degrees, the reading changed to −23 dBm, a loss of 16 dBm . . . almost 3 S-units. There was a pattern of sorts here. Note that I expected and noticed substantial reflection from objects around the KLM beam (including myself), much as might happen in the average amateur installation.

All right, let's put two and two together! Fact #1: SSB and CW modes aren't called "weak-signal modes" for nothing. Most of the signals you will encounter in this operation are many miles distant, using moderate- to high-gain yagis and 99% are horizontally polarized. Fact #2: When operating these modes, you'll often find an average signal level of S3 to S6 to be quite common. Conclusion: It's hard enough work to copy a station running S2 to S3 out of the noise while on SSB or CW. It's pretty well impossible to copy a station in the noise! Lose 12 to 18 dBm of that weak signal due to polarization losses, and you've lost the battle before it's begun.

The moral? If you plan to try some SSB or CW work on 2 meters, give it an honest shot and use a horizontally polarized yagi with some gain. Take that same weak signal, and you'll pull it right up out of the noise to Q5 copy with a 10 to 14 dB gain yagi.

Feature Dept.

I haven't featured anyone lately here, but a recent purchase brought a supplier to my attention that may help you as well. Kentronics, located in New Jersey, is a surplus test equipment store with a huge stock of goodies. The proprietor, Brian Kent, was helpful in locating a 50-Ohm BNC coupling for the previously mentioned Boonton rf millivoltmeter, allowing me to take signal measurements directly from antennas. He has a nice selection of used scopes, signal generators, and other test-bench material in good condition. Brian is located at PO Box 2444, Allaire Airport, Farmingdale NJ 07727, and his phone number is (201)-681-3229. Brian travels to many of the major hamfests (including Dayton). Just look for the fellow with the cigar amidst Tektronics scopes. Maybe he can help you as well.

Mailbag

Ron Manfredi WA2EIO of Merrick, New York, inquires about antenna changeover relays. Boy, have they gotten out of hand! Dow-Key division of Kilovac Corporation in California, makers of the familiar Dow-Key antenna relays for HF operation, also manufactures a line of relays for high-power VHF and UHF operation. Hold your breath, though; they will set you back about $200 for DPST types and $180 for SPDT types. A better way might be to consider plowing through flea markets for used units (they *do* surface from time to time). EME Electronics of West Germany makes an excellent UHF-type relay with N connectors. It's good for 1,500 Watts at 144 and 220 MHz, and in excess of 1,000 Watts at 432 MHz.

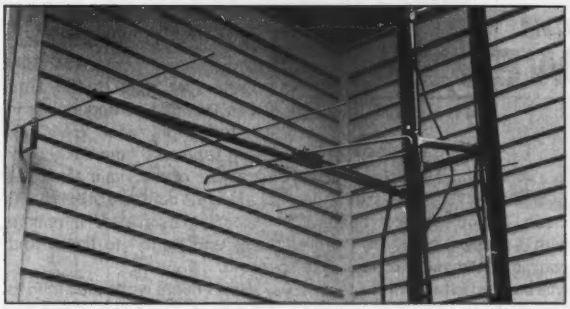

Photo D. The KLM beam in a horizontal plane.

Coil voltage is 12 V dc, and the units are available in SPDT configuration with and without external contacts. Prices range from $115 to $130, depending on contact arrangement. Contact the U.S. importer (The PX Shack, 52 Stonewyck Drive, Belle Mead NJ 08502) for further details.

Arturo Nelson XE1FV writes from Guadalajara, Mexico, to ask why I didn't include the Yaesu 726R in my comparative review of the ICOM IC-471A and Kenwood TS-811A (June, 1986). The answer is easy: I couldn't locate one from an area ham at the time! These units were not purchased for the test, nor did they come from the manufacturers for evaluation. I simply located two local amateurs with the units who agreed to lend them to me for the comparison. This way, I'd be sure to get something off the shelf without paying for it (cheep! cheap!). I am aware that the 726R is a very popular unit, and I do plan to obtain one shortly for evaluation. Then I'll plug the numbers into the comparison chart to see how it stacks up against the other two contenders.

Arturo uses his for OSCAR operation primarily, although he's in the process of putting up antennas for weak-signal DX operation on 144 and 432 MHz. A harsh noise environment has prompted his construction of stub and cavity filters for 144 MHz (welcome to the club, Arturo!). This is probably one of the more infuriating things you can encounter as an active VHFer. I know, because I fight it every winter, usually during the January VHF Sweepstakes! This is why I've gone to an ICOM 740S with transverter for the bulk of my 2-meter contest activity, since the 740 has an outstanding variable noise blanker. Between precipitation static and space heaters, it's a running battle to keep the QSO rate up. I'm not surprised that the noise blanker is inadequate in the FT-726R as Arturo reports—very few of the Japanese VHF multimodes have a decent noise blanker. The problem is that using one fixed setting for various types of noise won't work. ■

Photo E. The test rf source, an IC-2AT, feeds a Larsen quarter-wave antenna. A Bird 43 monitors steady output.

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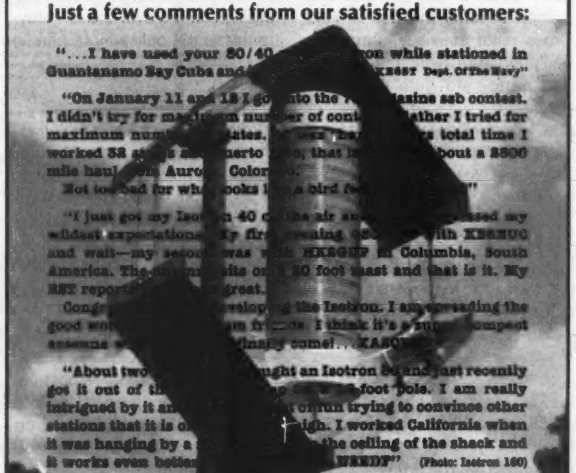

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AERO MEXICO CRASH

ARES preparedness in Orange County, California, was put to a test on Sunday, August 31. An Aero Mexico DC-9 jet on approach to Los Angeles International Airport collided with a single-engine Piper aircraft in the skies over Buena Park, a Los Angeles suburb. Both aircraft plummeted to the ground in the adjacent city of Cerritos. The DC-9 fell into a housing development, while the smaller aircraft crashed into a nearby schoolyard. All passengers and crew on the Aero Mexico jet and the three people in the Piper were killed. More people died as burning debris from the DC-9 destroyed 17 homes.

Amateur radio's involvement began when an official alert was called, activating the Orange County Red Cross and the Orange County Amateur Radio Emergency Service. ARES was to provide primary communications for Red Cross relief efforts. Using the facilities of the N6ME repeater on 145.40 MHz, the Red Cross Santa Ana Chapter amateur station WB6QDG was activated and it soon became the hub of Red Cross relief activities. Amateurs equipped with two-meter mobile and hand-held gear were dispatched by radio to the disaster site to coordinate communications for Red Cross operations. They also aided the communications of other disaster agencies. The operators performed like a well-oiled machine, proving again the value of regular emergency drill sessions. It appears as if two dozen or more Orange County ARES members were called into service before net management was transferred to the Long Beach Red Cross chapter office. Ancillary communications used the facilities of the KC6K 146.97 repeater in nearby Anaheim.

About an hour after activation, Net Control WB6QDG put out a call for mobile and portable packet stations. They were desperately needed at the crash site to handle high volume written traffic. With none initially available in the immediate area, hams from further away offered their services. One was a mobile packet station in a recreational vehicle in Riverside some 75 miles from the crash. The other was an operator with a battery-powered portapacket system in Pasadena. One was ordered to the Santa Ana Red Cross chapter building and the other to the disaster site. As word of the disaster filtered down to the digital community, local packet stations joined the traffic net. One of the few problems noted was that poor communications exist between the digital and analog factions of the local amateur community. We were told that most digital enthusiasts spend little or no time monitoring local voice communication. Several people have already told *Westlink* that this situation will quickly be corrected.

Even in a time of disaster, the southern California kook corps had to come out of their ratholes and add to the grief. During the emergency communications on the N6ME repeater, there were several incidents of malicious interference. The net control and the operators ignored the jamming and most of the interference disappeared after what appeared to be T-Hunt teams gave the names and callsigns of the alleged jammers over the air. Maybe this is the only way to handle the spoilers.

Analysis

I first heard about the mid-air collision from Joe Merdler N6AHU. A quick call to the newsroom of the television station where I work confirmed that the accident had taken place, and I quickly tuned to CNN Headline News to see if they had any further word. Nothing there, but KCBS had interrupted normal programming and already had live pictures from the crash scene. Almost immediately I saw a ham talking into an FT-208R. Ham radio was on the scene as a part of the rescue and relief effort.

ARRL Division Director Fried Heyn WA6WZO has spent a lot of time in building up a functional ARES operation in the Orange County area. Fried had started the job long before he was elected a League Director. The Orange County group has their operation down to an exact science. A few phone calls confirmed that it was Orange County ARES that had been activated to provide ancillary communications to the Red Cross. I learned the frequencies in use from April Moell WA6OPS. Being separated from the activity by a pair of mountain ranges, I plugged the numbers of the N6ME system into a private UHF remote base and began to listen and record.

What I heard made me proud to be a ham. The hams aiding the Red Cross relief operation utilized a minimum amount of talk to transfer a maximum amount of vital information. You could tell that the operators had spent their drill hours wisely. Their performance was all but flawless, proving once again the value of regular training exercises. However, this tragedy did point up two important negatives that require discussion.

Problem 1

The first problem was obtaining packet stations locally for dispatch to the disaster area and the relief coordination sites. As those of you who read last August's issue of *73* are aware, a vast network of packet operation has its own hub in the Los Angeles/Orange County area. In fact, packet is the fastest growing mode of amateur communication in California. There are thousands of packeteers already on the air, and hundreds of new stations are coming to the mode every week. So why, with all of this activity, should there be any problem in obtaining operators and gear?

The answer can be summed up in one word: specialization. As explained to me by fellow *73* columnist Harold Price NK6K, the "digital folks" and the "analog folks" have no common meeting ground. That is, the digital community spends little if any time monitoring any local voice communications, and voice-only operators who have no packet gear have no way to communicate with the digital-only groups. You can see why a problem with obtaining instant portable and mobile packet stations might arise. Harold feels that this problem can easily be overcome with a simple exchange of phone numbers, but I feel it has to go a lot further than that.

If packet radio is as important in emergency service work as it appears, then it is a must that all ARES groups have all their members packet-equipped—or if this is not economically feasible they should develop a second, parallel "Digital ARES Network" by either absorbing or utilizing the services of an existing packet group. This means that an NCS or other individual in a position of responsibility must be equipped with both digital and analog gear, and have the ability to operate both simultaneously or through a second, parallel NCS.

The overwhelming need for packet in the aftermath of this disaster is definitely an indicator of things to come, and while packet will never completely replace voice, the latter may soon become subservient to the former in situations where a high volume of written traffic takes place. The only variable is the human typing the traffic into the terminal or the computer.

Even though I am not yet active on packet, I am convinced that it will become the backbone of local, regional, national, and international traffic interchange within only a few short years. The digital transponder on board the new Japanese amateur satellite, Fuji (which the AMSAT folks call Japan OSCAR 12), is only a sample of what's to come. I am willing to say that packet will be the key that fits the coffin marked "Morse code." Packet will lock and eventually bury that box forever.

Red Cross and RACES take note. Packet is not the "wave of the future." Rather, it's the "wave of the present," and it's the most logical answer to your high-volume written communications needs. If you are not equipped with it, it's time to get your act in gear. If you have been awaiting proof of need, that proof is now here. An emergency phone-up list of available local packeteers can only be a temporary expedient. For packet to become a fully functional part of emergency communications, its operators must involve themselves in ongoing weekly training exercises, and an integrated radio call-up system must be developed that alerts the digital folks of a communications need at the same time that it gives this alert to the voice communications people.

Problem 2

Now to the other problem noted during this emergency: wanton and malicious interference to communications on the N6ME repeater during the emergency relief effort. You would think that in as tragic a situation as this even the worst of the nut cases would

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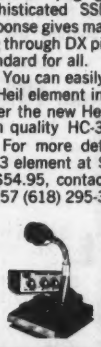

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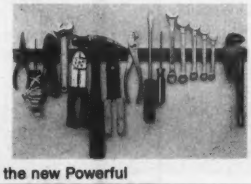

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have some respect for the dead and dying. Well, in an area where jammers consider themselves to be an elite corps, and where everything has been tried—including prison terms—to end jamming with only a modicum of success, what can you expect. I have long maintained that the real key to ending the problem is to never permit "a certain amount of jamming" to become the accepted norm. Well, in the Los Angeles area, accepting a certain amount of jamming appears to have become an acceptable standard of operation on the two-meter band, and it's the main reason that I spend very little of my time in Los Angeles on two meters. On the other VHF and UHF bands, no level of malicious interference is tolerated, and the rumor mills run rampant with stories of why "this jammer or that is now hospitalized." In fact, it's rather reminiscent of two-meter FM in New York City in the late 1960s. For the pacifists out there, I am not condoning violence. In fact, I cannot even say for certain that it has taken place. Maybe it's just all rumor and innuendo started to keep the fanatic fringe in its place. Whatever it is, it works.

But that's 220, 450, and other bands, not two-meter FM in Los Angeles. So, it was almost with amazement that I heard a transmission similar to this: "This is W6XXX mobile. I'm parked outside the home of NX6XXX and he is jamming the emergency communications." A definite statement of fact from a member of a T-Hunt team. Not one of those "I think it's NX6XXX" type transmissions from a base station 30 miles away. And the result? Silence from the jamming station. I can only hope that what this is really saying is: "We in southern California have had it with you jammers, and we are just not going to take it anymore! See you in court, jammer." It's about time.

"Even in a time of disaster, the southern California kook corps had to come out of their ratholes and add to the grief."

Fuji

There is a rather interesting aside happening between AMSAT and the Japan Amateur Radio League. It's not a knockdown, drag-out fight, but nevertheless it's taking place and it's over the name of the newest amateur satellite. Before its successful launch in August, we all knew the bird by the same name. It was called JAS-1. Some places wrote the name as "Jazz-One," but at least everyone was content with the one name. On August 12, that all changed. From JARL HQ in Tokyo I received the following telex message: "The H-1 rocket carrying the first Japanese Amateur Satellite JAS-1 has successfully lifted off at 20:45 UTC 12 August 1986 from the Tanegashima Space Flight Center." A few hours and several telex messages later, the following confirmation of success reached the *Westlink* newsroom, reading in part: ". . . new born satellite JAS-1 was named 'Fuji' by JARL today. Please call it 'Fuji' from now on . . . Shozo Hara, President - JARL."

That seemed simple enough. The JARL and its associated organizations designed, built, and orbited the bird, so as far as I was concerned it was theirs to name as they pleased. Why should anyone want to interfere? I really don't know the answer, but you might want to ask AMSAT since they insist on calling Fuji "Japan OSCAR 12," or more simply "JO-12." This apparently upset the Japanese more than a bit, and probably accounted for the delayed but emphatic follow-up telex bearing the Fuji designation.

Anyhow, the AMSAT folks appear to be adamant that they will be the ones giving Fuji its name, and as of September 1, 1986, the name that AMSAT is sticking with is JO-12. AMSAT's *Amateur Satellite Report* of this date fails to take note of the JARL preference for the Fuji designation. Who will eventually win this low-key international battle of the satellite name? In this case, I'll put my money on the Japanese. After all, it is their satellite, and they should be permitted to call it anything that they want. Who knows, maybe by the time you read this the satellite will have a single and accepted moniker. ■

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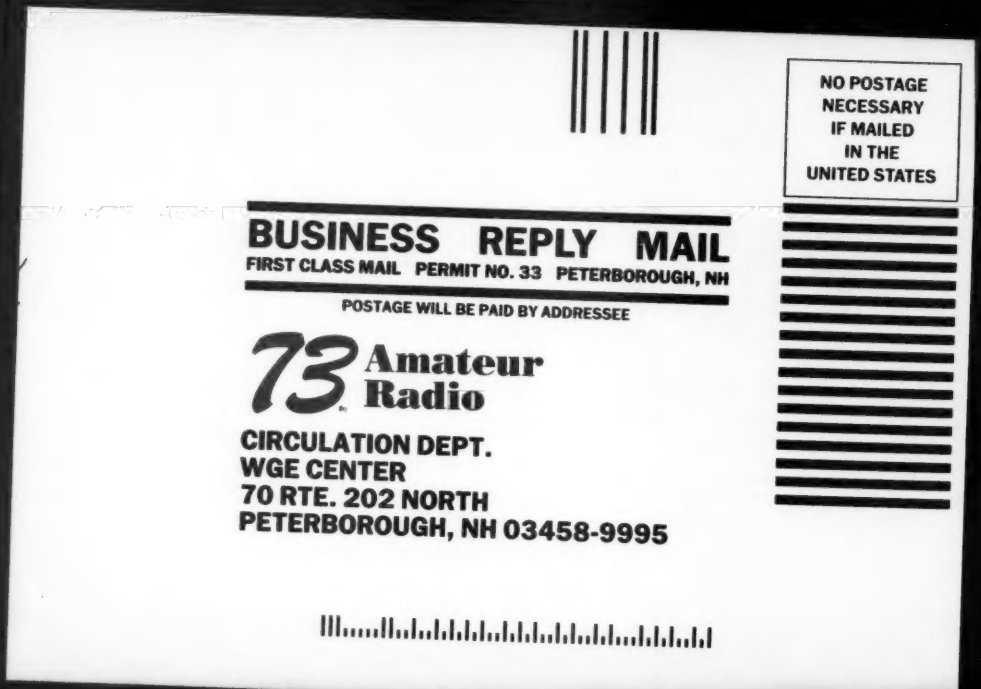
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73 INTERNATIONAL

Number 27 on your Feedback card

NOTES FROM FN42

Zambia has joined us this month and 73 International now covers the world from A to Z! Now how about the only four (possible) missing letters in between: O, Q, W, and Y? The first three can be only Oman, Qatar, and Western Samoa (an independent state) but either the Yemen Arab Republic (North Yemen) or Yugoslavia would cover the last. We are waiting. . . .

BRITISH WEST INDIES

Roger A. Corbin ZF1RC
Secretary Cayman Amateur Radio Society
PO Box 1549
Grand Cayman
British West Indies

Have you been wondering why you did not receive a QSL card from your contact with a station using a ZF call? Here's the explanation, and some additional information from a lovely spot in the Caribbean Sea.

ZF2 callsigns may be used only when an operator is in the Cayman Islands. An operator who signs /ZF2, portable ZF2, or ZF2 maritime mobile is operating illegally and QSL cards received by the bureau operated by this club for stations using the above calls will be destroyed.

A year ago this month (November) a station using ZF1RC with an operator calling himself Ron was operating illegally, and a number of amateurs seeking QSL cards now cannot be served. To compound the confusion, that was the call assigned to me a month later, on December 21, 1985.

The Cayman Islands do have reciprocal licencing agreements with a number of countries, including the United States, but sometimes we get left off the lists. It may appear to many amateurs that it takes a very long time to get a response to QSL cards sent through the local bureau. This is due mainly to the fact that most of the ZF2 operators visiting our country forget to make arrangements for cards to be forwarded. We are taking steps to try to correct this situation. This club now operates an open repeater on 146.76 with a 600-kHz negative input frequency. The simplex frequency most regularly used locally is 146.52 MHz. 73, ZF1RC.

CANADA

Dean Milner VE1CBF
28 Castle Drive
Sydney, Nova Scotia B1S 2A2
Canada

Canada returns to 73 International after an absence of nearly three years. . . but was well-represented during that period in other parts of the magazine. Our new correspondent, VE1CBF, would like to know what readers would like to hear about. Let us know here at 73 (mark for "International Editor") or, if you write him directly, send us a copy of your letter so that we can know, too! Time and space constraints for this issue made it necessary to pass on only the following from his first report.

The Canada Day Contest in July showed again a noticeable increase in participation of amateurs from outside Canada, some seeking points toward the Canadaward. The next Canada Contest will be, as usual, on the last weekend in December. For a copy of the rules and/or more info on the Canadaward, write the Canadian Amateur Radio Federation (CARF), PO Box 356, Kingston, Ontario, K7L 4W2, Canada.

The fight continues in the case of Jack Ravenscroft VE3SR, off the air per a court injunction "as he was creating a nuisance. . . by interference to electronic appliances" in a neighbor's home. An appeal has been filed against the liability finding and damages awarded, and the case is being followed closely by the Department of Communications and all rf spectrum users. Jack's legal expenses currently stand in excess of $15,000, and he is grateful to amateurs from other countries who have made contributions to the Jack Ravenscroft Susceptibility Defense Fund (PO Box 8873, Ottawa, Ontario, K1G 3J2, Canada) to help him out. He also is grateful for the moral support he has received through letters.

CUBA

Eduardo Fernandez Rodriguez
Presidente, Federacion de Radioaficionados de Cuba
Apartado Postal No. 1
Habana 1
Cuba

We welcome Cuba to 73 International; Rafael Fernandez CO2RX will be our correspondent. Sr. Fernandez is the FRC officer responsible for liaison with the IARU and knows a lot of amateurs who can supply him with items for this column.

We have the Cuba DX Group (G.DX.C.) created about one half year ago which has about 55 hams. We have a certificate for those who establish two-way contacts with four members of the group. The FRC invites you to join the Group for life membership. For 30 IRCs or US$10 we will send you a membership certificate, decals from the G.DX.C. and FRC, a G.DX.C. pennant, an FRC pennant (all these in full color), a personal unit number, postcards and stamps of Cuba, and a roster of members. Your station will count 1 point for the G.DX.C. Award.

With your application (send to the above address) let us have your full name and address, DX-CC countries confirmed, itemized list of your equipment and antennas in use, bands and modes you operate, languages you speak, and let us know: Do you QSL? Have you been on any DXpeditions as an operator? Do you have any of the following awards: DX-CC, WAS, WAC, WAP, WPX, WAE, AAA, ADXA, DUF, BERTA, Cuba, G.DX.C., Caribe and/or America (see some of these described below)?

Concerning visitors, we have had Canadian, German, Spanish, and Bulgarian hams who have operated our club equipment and made many contacts. If anyone wants to visit and operate, we recommend you let us know two or three months in advance to make the necessary coordination with the Frequency Management Authority in order to get a provisional license—or you could write direct to: El Director, Direccion de Frecuencias Radioelectricas, Ministerio de Communicaciones, Plaza de la Revolucion, Habana 6, Cuba.

Concerning the growing of amateur radio in our country, it is going on. For instance, in 1981 we had 315 members in our Federation who were licensed to transmit and in 1986 we have 730 members with 464 licensed to transmit, and we have 534 licensed stations, 18 of which are club stations.

We have a QSL Bureau, of course; it is at the FRC address.

Cuban prefixes are CM for second class stations or Novices and CO for first class stations and Juniors. CL and T4 are for special events only.

South of Cuba is a key called Cayo Largo which is a wonderful place for DXpeditions, tourists, and rest, for which a visa is not needed—it is possible to arrive there direct by plane or ship. I would be happy to provide additional information if you would like.

[*Editor's Note: Remember always to send IRCs with letters you write as a result of information you read in these columns, when you are asking for replies.*]

AWARDS

For OMs and SWLs, SSB, CW, 1 band or 5 bands, do not send QSLs but only list of contacts including date, time, band and mode (certified by your radio club or two licensed hams), with 10 IRCs or US$2 per award; mail to Award Department, G.DX.C. at above FRC address: Cuba Award.Work (hear) the eight districts of Cuba (CM1–8, CO1–8); up to three missed districts may be substituted for with radio club stations. Use three suffix letters. America Award. Work (hear) countries and islands in America. Class III (category C) 30 countries and islands; Class II (category B) 40; and Class I (category A-Excellent) over 40. G.DX.C. Award. Work (hear) four members of the Group, any nationality. Identify with QSLs. For the Caribe Award, any mode, any band, work (hear) countries and islands in the Caribbean, including XE, VP1, TG, HR, YN, TI, HP, HK, and YV. Class III (C) 20–24 countries and islands; Class II (B) 25–29; and Class I (A-Exc.) 30 and over.

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CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Cyprus on paper seems to have a very large number of amateurs compared to its population. There are nearly 500 licenses to a population of about 650,000, but unfortunately the really active amateurs on the HF bands are not more than a dozen. Most amateurs are on VHF or they gave up the hobby, changing to another one. There is, however, an encouraging factor. During the last radio amateur examinations quite a few young people got callsigns. Some of them are harmonics of old amateurs, one of them being my second harmonic, John 5B4TZ, who is going to operate on HF regularly.

Catching you up with news of Cyprus: In 1985 was the 25th anniversary of the Cyprus Republic, and Cyprus amateurs were given the special prefix of 5B25 for use between August 17th and December 31st. This gave the chance for many amateurs to work this prefix and the 5B4 activity was increased at the same time. Unfortunately no award was programmed for the occasion, but the old Cyprus Award is still available.

Some of the specialized modes have started to be in use by Cyprus hams. On RTTY-Baudot we have (5B4)OK, OA, OP, NA, NG, IT, MC, and MD in Nicosia, JE, OV, and CV in Limassol, and CR in Larnaca City. On AMTOR, we have in Nicosia MD, OA, OK, FN, and IT. They are still experimenting and also use auto-AMTOR.

The master of satellite communications is undoubtedly Akis 5B4OA, who is QRV regularly on OSCAR-10. Others active on satellites are Spyros 5B4MF and Andreas 5B4LP, who operate from their school club station, 5B4ES.

On SSTV we have Nicos 5B4CV as our number one, and (5B4) HF, OA, MD, and OK.

On the VHF scene we have Andreas 5B4LP, who is the only one operating meteor scatter, and in 1985 he had fine contacts with UB5 and 9H1. On sporadic E, 5B4 hams had successes with LZ, YU, SP, HG, UB5, and I. During the recent June sporadic E opening, Nick 5B4AZ, using only a handheld and 1/4-wave telescopic whip on his FT-290, worked about ten stations from Italy.

Peter G4UIK operating from 5B4JE's shack as G4UIK/5B4.

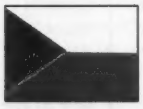
On tropo during the summer, contacts are quite easy between 5B4 and all the neighboring Middle East countries. All Israeli repeaters can be accessed and also the Amman repeater in Jordan sometimes. Simplex QSOs are also made with OD, 4X, JY, SU, SV5, and SV9 lands.

Although contesting in Cyprus is not so popular with the majority of amateurs, regular participants in various contests include 5B4MF, 5B4LP, 5B4DN, 5B4NC, and 5B4ES. Their results were very good, and at the last annual General Meeting of the Cyprus Amateur Radio Society, Spyros 5B4MF and Andreas 5B4LP were awarded honorary plaques in recognition of their activity and promotion of the hobby.

During the past few months many foreign amateurs have visited the Island and met many local amateurs. Mike A71AD came in May and has now settled in Nicosia, operating with the call 5B4TI. Also visiting Nicosia, SV5RW and OH8MA. In my own shack this summer, I had Jim GM4HKW, Peter G4UIK, Rudi DJ0MAF,Alecos SV2QO, Peter OH1RY, and Amir 4X6TT. It is always a pleasure to meet hams from other countries, and if anyone is visiting Cyprus, do not hesitate to contact 5B4 hams.

ZC4 activity is regular, especially on CW. From Akrotiri base, the most active is Adrian ZC4AP, and from the Dhekelia base, ZC4MR and ZC4EE. In the very near future the Episcopi club station, ZC4EPI, will be operational, and the secretary, ZC4DA, informed me that 5B4 amateurs of the Limassol Group will be allowed to operate from their club station as associate members. So I hope that I will be operating myself from there as ZC4EPI and enjoy the pileup.

Last item is the announcement of the operation of a new club station in Limassol, 5B4BBC. It was founded by the ham employees of the BBC relay station in Cyprus, and its first president is Andy Matheson 5B4DN, who also is ZC4AM.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Gogol'ova 1882 955 01
Topol'cany
Czechoslovakia

As this is being written, all four semifinalists in the U.S. Open Tennis Tournament are Czechoslovakian. It seems safe to predict that the men's and women's champions will be Czechoslovakian! Congratulations, Czechoslovakia!

Czechoslovak radio hams sincerely invite American hams to take part in our OK–DX Contest; the general level of the contest will be raised by your participation. It is scheduled for November 8–9, Saturday and Sunday, 12 o'clock to 12 o'clock UTC (being the usual 2nd November weekend). 1.8–28 MHz on CW/SSB. Contacts OK on same band for CW and SSB. CW: on 20 and 80, use the 3.500–3.560 and 14.000–14.060 windows for CW; SSB on all frequencies. Band changes only after a 10-minute minimum on one band.

Ferdo OK3CXW DXing on 80-meter SSB.

Three points for contacts with OK and OK4/MM stations, one point for other contacts (except no points within your own country). Multipliers are zones according to the ITU list, on each band separately. Total score: all contact points times all multipliers. Categories: single operator, single band; single operator, all bands; multi-operator, multi-bands.

Send logs in usual way, reports and ITU zone, before the end of November, to Central Radioclub, PO Box 68, 113 27 Praha 1, Czechoslovakia.

EL SALVADOR

Marco A. Orellana YS1OD
PO Box 464
Calle Progreso 3332
San Salvador
El Salvador

Welcome to YS1OD! More from him in the future, but in the meanwhile he wants us to know. . .

I'll be glad to be [the El Salvador correspondent] and help any ham who has interest in visiting El Salvador for a short, medium, or a long period, as visitor or temporary resident. In case some DXpedition wants to operate from this country, I will like to have all the information at least 60 days in advance in order to do all the paperwork for the government and also to get prepared to welcome them.

We have two QSL Bureaus: Radio Club YSDX, PO Box 05–43, Metrocenter, San Salvador, El Salvador, and CRAS QSL Bureau, PO Box 517, San Salvador, El Salvador.

If any ham needs information about how he can operate here, he can contact me at the above address; telephones: direct international dialing: (503) 23–8183 or (503) 24–3954.

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GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

In my column last January, I have told you of some of the problems we often have with illegal operations from Mt. Athos. Now I am going to tell the legend of Mr. Frank Turek DL7FT and his efforts to put this rare country on the air.

This year, as in 1985, he wasn't even inside Mt. Athos territory but operated from somewhere outside, as usual. Of course he says always that he was inside and that he had a license for that and all those good things to hear, but the truth is rather different. He never had and never will have a license other than the "Diamoneterion" (staying permit) which says one may visit and be in the monasteries for religious purposes only—and he may not even have had that since you don't need it if you never go inside Mt. Athos.

Last year we made a protest to the German PTT. This year we are going to have reciprocal agreements between West Germany and Greece reconsidered.

We remind you that the law covering amateur radio operation in our country for Greeks and foreigners clearly states: in order to get permission for amateur radio transmissions from the Holy Mountain, the applicant needs a written permit from the Holy Community of Mt. Athos as well. (From Legislative Decree 271 of 30/April/76—Official Gazette 102/B.) Furthermore, we strongly believe that certain rules have to be obeyed when somebody is participating in the DXCC Award (paragraph 12 covering operating ethics).

Mr. Turek went also a little bit further this year. He tried to throw mud on our operation back in 1980 (SV1DC/SV1IW/SV1JG), saying he had proof that we were operating from a hotel . . . but he didn't care! (What a big heart he has!) The least we can do is to show our pictures: one of the "the hotel" with the 12AVQ on top of it, and one of SV1DC's head popping up through "the hotel's" roof!

The story goes on with DL7FT in SV5 for a new expedition from May 3 to 25. He announced it as mostly to give a new one to the Japanese. He also promises to go again to Mt. Athos after SV5 in order to take care of those unlucky ones who missed him the first time.

On the other hand, the RAAG (the Greek association) received a letter from our PTT stating that the license of Mr. Turek has been revoked as of April 24, 1986 (see Fig. 1). The reasons are clearly stated. The police then began looking for him on Rhodes in order to stop his activities, but he couldn't be found anywhere. Meanwhile he continued running his expedition despite the fact that three Greek and some German operators told him to stop because of the PTT decision.

To make a long story short, DL7FT was found on May 21 at the Ramira Hotel on the island of Cos, the second most populated among the twelve Dodecanese islands. You see, he got his license for Rhodes but went on to Cos . . . you may imagine why.

His operation was stopped and his radio was sealed and kept at the airport customs office to be given back to him at his departure from the country.

And now the grand finale! During a conversation with Don Search, Don told me that DL7FT had provided him with all necessary papers including a Mt. Athos one just like the one I had in 1980 for my trip! Since all papers arriving at the DXCC desk are treated as confidential, Don couldn't do more than provide me with permit numbers and dates.

A letter was forwarded to a friend of mine in Mt. Athos the next morning with all the details in it, and a few days later the matter was revealed. The Mt. Athos community had never issued such a license, Mr. Turek was unknown, and most important, the protocol number did not match with those issued by the community.

I leave the conclusions to you. Not hard to guess.

Common sense now says that it will be even more difficult to get a written permit for Mt. Athos again after all these sad events. We hope we will not have to face the unhappy situation of seeing Mt. Athos among the deleted countries. We believe we should have nothing more to do with DL7FT's operations; we regret that a DXCC Honor Roll holder should have provided such an example to younger DXers—making the DXCC certificate look like a piece of worthless rubbish.

By the way, I will be glad to forward any documents to anyone who would like to look at them. Please do not bother the editors of *73* but send your request, if any, to me direct.

GREEK DEMOCRACY
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF POST AND COMMUNICATIONS

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TO:
The Security Dept.of Rhodes,
85100 RHODES
NOTIFICATION TO : Radio Amateur Association of Greece,
P.O.BOX 3564 Athens 10210

MATTER IN HAND : REVOCATION OF TEMPORARY LICENCE FOR OPERATING AMATEUR RADIO STATION.

We acknowledge that in our letter (ref. no. 52352/29-1-86) which was also sent to your office we granted a temporary licence for possession and operation of an amateur radio station to the German radio amateur Mr. FRANK TUREK.

Since the aforementioned, in accord with a written report made by the Radio Amateur Association Of Greece, exhibited wrongful behaviour toward the Spirit of Amateur Radio violating even the current regulations (such as using a false call-sign, a phoney declaration that he was transmitting from Mt. Athos which is forbidden,making sarcastic and derisory remarks to Greek Amateurs etc.) Our Department revokes hislicence which it had granted.

Therefor,since Mr. Turek in his application said that from 3rd to 25th May he would be in RHODES,we request that you locate him to take away his licence for possession and operation of his amateur radio station (ref. no. 52352/29-1-86) and to seal up his radio equipment which is an ICOM transceiver model IC-730 serial no. 06027, so that he will not be able to use it until his departure from Greece.

Our Department will at the same time notify the corresponding German Ministry.

The Supervisor of Ministry Of Transport and Communications

S.BARABOUTIS

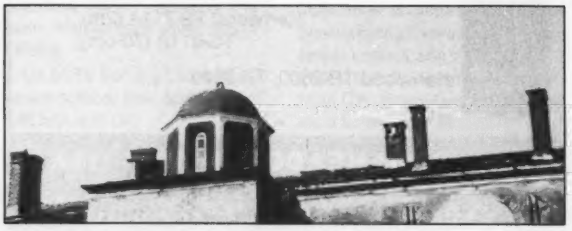
Fig. 1. The revocation notification.

INDONESIA

Erlangga Suryadarma YBØBZZ/V85BZ
ORARI National QSL Bureau
PO Box 96
Jakarta 10002
Indonesia

August and September report by YBØBZZ and Ben S. Samsu YBØEBS.

The International Beacon Proj-



The erected antenna at Mt. Athos, 1980.

SV1DC prepares to erect the antenna on the monastery roof, 1980.

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64

PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

Prices and specifications subject to change without notice or obligation.

↩65

AEA

Advanced Electronic Applications, Inc.
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"When You Buy, Say 73"

ect (IBP) has not been considered by ORARI [Organisasi Amatir Radio Indonesia] at the present time. However, realizing that the present established IBPs in IARU Regions I, II, and III are well spread geographically [and] Indonesia is strategically situated at the intersection of two major continents and two major oceans [it] is also a "mid-point" [and a] suitable location. Should there be any plan within the IARU Region III association in this matter, ORARI will highly extend its support and cooperation.

[ORARI plans to add to its calendar of annual events an International QRP Day, probably on June 17 since that is the day so proclaimed in IARU Region I. This is because of the new feeling of "the bigger the better" resulting from the increase of imported equipment and bigger antennas and bigger power.]

It is the opinion of ORARI that whilst some of the world contests such as *CQ* WW have a very strong foothold in the world amateur activity, it is of great pity that the one and only World Amateur Radio Day was not celebrated by all amateurs accordingly. ORARI wishes to appeal that this special day should be programmed . . . as the most important and greatest event, and all IARU society members [think of themselves as] obliged to participate.

ORARI wishes to support the establishment of a common frequency preserved primarily for DX requirements which in no condition except for emergency communications will be utilized for local communication. This will preserve also the segment for DX contest purposes, as, at present, it tends to be fully blocked by local communications in that segment. Example of this is the usage of DX-window segment in the 80-meter band.

This report will conclude next time with a section on the new band plan.

ISRAEL

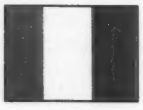
Ron Gang 4Z4MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

FLASH!

Easter in the Holy Land with the Holon-Bat-Yam Club! [You can be there!] In the last edition of this column I reported on the week-long 4X5J operation of the Holon-Bat-Yam radio club, ending my comments by stating that I didn't know what they had up their collective sleeve for the coming year. Since then, the dust has cleared and it has become evident that they really intend to outdo themselves for this coming spring. Thus, I have the pleasure of announcing to the readers of *73* their project, which will consist of the simultaneous operation of five stations bearing special callsigns, from five separate locations: Bethlehem, Jerusalem, Nazareth, Mount Tabor, and the Mount of Beatitudes (above Capernaum on the Sea of Galilee). The operation is to take place from the 23rd through the 30th of April.

In order to man these stations around the clock, the club is looking for 50 or more overseas radio amateurs, who are invited to come with their families, who will take turns operating the stations, and will be sightseeing on their days off. Operators should be experienced in handling pileups and preferably should know how to make QSOs in a few languages. Those interested in this combination of holiday and hamming should write to Aharon Kirschner 4X4AT, HaRakefet 17, 58204 Holon, Israel.

As with the Holon-Bat-Yam Club's 4X5DS (Dead Sea) and 4X5J (Jerusalem Old City) operations, special QSLs and certificates will be sent free of charge to those making contact with the Easter-1987-In-The-Holy-Land stations.



ITALY

Manuel F. Calero I4CMF
Manager, IARS Reciprocal Licensing Unit
Via Giorgione, 16 I–40133
Bologna
Italy

Herewith additional information from the IARS [International Amateur Radio Service]; see 73 International *for July, 1986, also. The IARS was founded as a private, nonprofit organization by I4CMF and I4OCS for the aim "of promoting friendly relations between radio amateurs throughout the world by assisting in negotiating reciprocal licensing agreements between Italy and other countries." The organization "considers the six universally recognized and accepted articles of the Ham Radio Code [Paul M. Segal—see any edition of the* ARRL Handbook*] to be the guideline for their activity, with mutual respect for each person's rights and duties."*

The latest country with which Italy has reached a reciprocal licensing agreement "is the 'oldest' and 'noble' Republic of San Marino, very well known also as 'Monte Titano' (Mount Titan), from the name of the main peak of the land. We are very happy to give you this news because this agreement is the first one that our 'small' neighbor has reached in its history of radio amateurs."

Eighteen other countries have such agreements with Italy. The IARS emphasizes the need to observe all "bureaucratic formalities which, unfortunately, continue to exist because each country still continues to carry along its own set of regulations. However, it is hoped that with the institution of the 'European' license, promoted by C.E.P.T., free circulation rights will be granted to European ham operators. This objective is a particularly important one which IARS is committed to and which it is counting on achieving soon. The goodwill and desire to work towards a goal which will bring OMs throughout the world a little closer together, with no distinction of race, nationality, or creed, is certainly NOT lacking!"

ZAMBIA

Daniel E. Soko 9J2DS
PO Box 71831
Ndola
Zambia

Welcome, 9J2DS, Secretary and Awards Manager for the Radio Society of Zambia. We will be pleased to hear more from you not only about Zambia but your neighbors also: Tanzania, Malawi, Mozambique, Zimbabwe, Namibia, and Angola, and even more distant neighbors in southern Africa.

At present, Zambia has 30 licenced radio amateurs, although about ten would be considered very active. The Radio Society runs a weekly net on 3.645 MHz every Friday at 1900 UTC. A rough check on Tuesdays at 1730 UTC on the same frequency may reveal a bit of activity as well.

Any ham is welcome to 9J2-land, and it would be helpful to all if you would send a photocopy of your licence well in advance to make arrangements for a possible temporary licence. Send it to me as Secretary of the Radio Society of Zambia at our headquarters and QSL Bureau: PO Box 20332, Kitwe, Zambia.

This year alone we were privileged to see Lloyd and Iris Colvin, W6KG and W6QL, for a short while. Lloyd was given the call 9J2LC, and Iris, 9J2IC. The couple operated mainly from their hotel room in Lusaka using their own equipment.

Soon after, a visit was made by Dilip 5Z4MR, who was issued 9J2DRT. He also qualified for the WZA after contacting ten stations within Zambia. Special callsigns are issued from time to time mainly on application to the licencing authorities.

Only five have 2m rigs and they are scattered about. A lot of interest is shown for 144-MHz operation, but finding equipment is a big hindrance. The five have thought of a repeater or two, but the same problem of equipment is manifested. Any kinds of donation in the form of kits for repeaters and actual 144-MHz rigs which may be obsolete, from other hams, but still in good working order would be a great step. . . . [What have you or your club to give? Let *73* International know about any donations! With photographs if possible.]

Hams are permitted to operate mobile as well. Third-party traffic, however, unfortunately cannot be discussed.

The WZA certificate may be won as follows: 9J2 stations contacted on 7, 14, 21, and 28 MHz count one point; on 10, 18, and 24 MHz, two points; and on 1, 8, and 3.5 MHz, three points. Special prefixes count two points. Same stations contacted again on other bands count again. Zones 36, 37, and 38 need 20 points for the award; all others need 10. The award is available to SWLs; there are separate classes for AM, CW, SSB, and mixed. Send certified copies of logs to Awards Manager with 10 IRCs, 50 pence, or US$1.

Let us hear from you! 73, Daniel. ■

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NEVER SAY DIE

from page 62

My recommendation for getting into your own business is to either start at home in a small way and learn so your mistakes won't blow your cash reserves—or learn on someone else's money. Just about every entrepreneur eventually needs help as his business grows, providing you with exactly the learning experience you need—just not at your expense.

If you don't blow your best learning years—from 45–65—when you get into the time of life that larger businesses normally throw you out to die, you'll have your own business and not have to worry about which ham magazine you can afford—or even which rig to get. You'll get the best—and perhaps a spare to take along on trips to Africa the way Lloyd and Iris Colvin do.

Then, when I ask in an editorial who's interested in going down to some obscure Caribbean island with me for a few days of instant DXing, I'll get an enthusiastic letter from you. The fact is I'm writing this editorial while sitting on the beach on Cayman Brac, a tiny island south of Cuba. It's skin diving heaven, so I've been here taking underwater pictures of the beautiful reefs.

Now here's an island which is easy to reach—has very nice hotels and great food—wonderful skin diving—is surprisingly inexpensive. . . what a great spot for a continuing DXpedition! What I have in mind is setting up a first-rate ham station for you to time-share—like a condominium. I haven't priced everything out, but I'll bet we could offer three days of hot DXing, including hotel, food, and transportation, for under $750.

Having done a good deal of DX-peditioning, I can assure you it's an experience you'll never forget. The Caribbean is an ideal spot, too, because it's easy to get to—there are nice hotels (beats the heck out of tents)—licensing is easy—the weather is usually excellent—transportation is convenient—it's close by—and, best of all, the propagation into the U.S. is first rate.

DXing from Lesotho (my call there: 7P8CA), for example, has its drawbacks—like taking a long time to get there—costing a bundle—and then, once you're there and on the air, you don't hear much. Really a great combination.

Speaking of entrepreneurialism, *Insight* magazine had quite an article on the problems American Indians have been having. It seems they, like the blacks, have a culture which does not encourage entrepreneurs, with the result that the Indians are gradually losing everything. They're poor as a group and staying that way.

Our educational system generally supports this lack of prestige for business people. College, in particular, aims at preparing graduates to work in large businesses, for the government, or for teaching. If you think about it, you'll recognize that these are the three best career paths to never make any serious money. College seniors are beseiged by recruiting teams from our large corporations—a kind of feeding frenzy takes place which sweeps most graduates into these virtually dead-end career paths.

A couple times during my life I came close to working for the government. After WWII ended I was teaching electronics at the submarine base in New London. When it came time for my release from involuntary servitude I was anxious to get the hell out. I'd risen to a first-class electronic technician. During the war the Navy had refused to let any of the ETs sign on as regular Navy, so suddenly they found themselves losing the people they needed the most. I was offered a Lt. Commander's rank if I'd stay in and teach. I might have stayed if they'd upped it to Captain. Close call!

Another time, after I'd gotten absolutely fed up with being a television director, I applied for a GS engineering position. By the time they got around to accepting me, better judgment had fortunately taken over. That's when I made my first big entrepreneurial leap, starting a loud-

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I'd like to see our colleges include courses to help people become entrepreneurs. Small business is the strength of our country, so it should be encouraged and youngsters should get educations which help them in this direction. I'm no fan of big business. I've got a book written by a VP of GE called *Big Business, a Threat to Democracy*. He makes a very good case.

Big business is driven by quarterly business reports—so we see lobbyists in Washington protecting their interests—a general lack of regard for the environment or people. We see cigarette firms selling their proven killer drug to millions of helpless addicts. I watch with pain as the few nicotine drug addicts who work for me sneak out back of the building for their drug fix every hour.

Life is a gamble. Every day we gamble as we drive or even walk across the street. Yet I see people refusing to go to Europe on vacation because they don't want to gamble on being the target of a terrorist, yet who take a far, far greater gamble by smoking. Talk about rolling with loaded dice! Cigarettes are just as deadly as Russian roulette—it's just a longer game. How soon will it hit is the question. Will it be cancer? Emphysema? A heart attack? Will the cancer be in the throat? Lungs? Intestines? Or will it be a stroke? Will you be hit before you reach 70? The odds are enormous that you will.

So we see big firms throwing every legal obstacle they can in the way of any government regulations which might slow down their polluting and poisoning. The alarms about the damage to our upper atmosphere are being verified—the result has been a stepping up of lobbying to prevent government action, not major efforts to develop chemicals which will not cause this apparently irreversible damage. So we continue to use spray cans—and produce millions of tons of refrigerant a year. The profits in the next quarter are a lot more important than what happens to the world in 50 years. Other than being needed to compete with other huge businesses from other countries, it's difficult to justify most big businesses.

Small business provides more jobs, more wealth for the people, more innovation—and even pays more taxes. Of course small business doesn't offer quite the gambling opportunities we get with large corporations, with their stocks and bonds and our stock exchanges. And without our megabanks, how would Third World leaders ever get the billions for their Swiss accounts?

The compact disc business is growing rapidly. I've been visiting CD-only stores in recent months. Just about every one I've visited has been able to get into the black in three to five months—not bad for opening a new store. Entrepreneurs who keep a weather eye on technology have an edge. I'm in the process of changing my computer store chain into high-tech stores, adding telephones, compact discs, CD players, and a few other high-tech gadgets. If the 8mm video firms decide they're going to make a major effort, we'll add an 8mm department too.

There are opportunities at every turn for the entrepreneur. Every new technology opens opportunities for new products to be designed, manufactured and marketed. A thousand small outfits sprang up with TRS-80 support products a few years ago, with hundreds of them doing very, very well. That was before IBM outsmarted Radio Shack, taking advantage of the incredible Radio Shack blindness to the power of third-party support of their computers. Well, that blindness cost Radio Shack tens of billions—and gave IBM the microcomputer industry as a gift. So, instead of IBM having to put out a TRS-DOS computer, we see Radio Shack resigned to bringing out MS-DOS computers just to survive.

If we can get amateur radio growing again as a hobby and as a market, we'll need hundreds of new ham products—antennas, tuners, amplifiers, packet equipment—things which you might just be able to design and start making. In the meanwhile you might want to see what you can come up with for compact discs, for 8mm video, communications, security, or any of the other new high-tech fields. It can be any product, service—or even information.

You get too soon old and too late smart, as the saying goes—so the sooner you start thinking

in terms of being independent economically, the better. It's bad enough to work at a job all your life which doesn't allow you to splurge now and then, but then to face retirement with even less . . . ? Imagine, having so little money that you have to pass up subscribing to a ham magazine you enjoy!

The early conditioning we get from our parents is important. My grandfather was an entrepreneur—made millions as an inventor in the 20s. He lost everything in the 1929 stock market crash, but that didn't faze him. He got right back into business again marketing a new type of indestructible brake lining invented by an uncle of his. My father was an entrepreneur—started the first transatlantic airline—so I had the right mind-set to be an entrepreneur. And that's important, as we can see from the black and American Indian experiences, where social priorities are keeping these groups from success.

BEING DISAGREEABLE

The theme at the *73* booth at hamfests for years has been, "I enjoy your editorials, but I don't always agree with 'em." Excuuuse me, but that's a cop out, so let's think this one out.

First, many more bureaucratically inclined readers have a problem with my whole way of writing. I'm amazed at how many words some writers use to communicate their ideas. Being of Yankee lineage, I tend to try to get across my ideas with as few words as possible. Yes, I know my editorials seem to go on endlessly, but—hey—take a closer look and you'll see I've covered a wide range of topics, none in any exhaustive detail.

Readers who are more used to writers who endlessly repeat themselves, rather than using my approach of just presenting almost an outline of the ideas, often have a problem. I've never been paid by the word, so I've never developed the redundancy system of writing to maximize my income with a minimum of ideas.

I'll tell you what. The next time you get the feeling that you're not agreeing 100% with what I'm writing, let's see if you're operating on the basis of my disturbing a belief of yours or if you actually have some data that I don't which might lead me to different conclusions.

Now, if we're having a difference of belief—a religious difference, you might put it—let's remember what my grandmother used to say—a man convinced against his will is of the same opinion still. And on quite a few ham subjects we're as much up against religious fanaticism as are the Moslems vs. the Christians, the Moslems vs. the Jews, the Protestants vs. the Catholics, and so on. Like no-code, for instance, where the born-again agnostics are up against old-timer intransigence. Heh!

So, instead of taking the easy out of just not agreeing with me, let's see if there's really any substance to your disagreement. Let's see if you can articulate your objections. I suspect you'll find as you try to explain yourself that you are operating on some weak premises. You may begin to suspect that if I'd hammered my ideas home over and over again—preaching the sermon, so to speak—you might have agreed with me. Well, I don't. I try to put as much meat into what I write as I can, leaving out the fluff, fat, and overkill.

Now and then I've pinned down readers who claim they don't always agree with me. "Okay, name one thing I've written with which you don't agree." This often flusters people into generalities or sudden memory loss (SML). Instant amnesia. When a specific area of disagreement is cited, I appreciate it because I can then find out if I'm up against a religious conviction or a question of facts. If I am wrong about my facts I sure want to know. What usually happens is that my facts are a lot more solid—or I'm able to bring to light some of the background on why I wrote what I did.

You see, I have a psychological problem. I was brought up in a family where any vague statement was challenged, so I learned early on to do my homework or suffer the embarrassment of Being Wrong! The dictionary was whipped out at the slightest question about a word's meaning or pronunciation. This helped me build a larger than average vocabulary.

So let's bring this business out in the open. The next time you find yourself disagreeing with me about something, is it because

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Imagine a **CW/RTTY/ASCII/AMTOR** machine that operates with a TNC-like command structure, including **54 commands.** The UTU-XT does just that with a 6303 microcomputer, 2K of RAM, NOVRAM, and 128K of EPROM embedded inside.

UTU-XT is also compatible to any computer with an RS232 or TTL (C-64) serial port — the circuit is built in. This allows you the flexibility to change computers at any time.

UTU-XT operates CW from 6-99 WPM, RTTY from 45 to 300 baud. ASCII from 110 to 300 baud, and AMTOR modes A, B, and L. Selective RTTY and SELFEC are included.
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you have some beliefs which I've disturbed or do you really think I'm working with poor information? If you've got data I don't, let's see what you've got.

I'll be glad when we're able to use our home computers to cross-index magazines and books. I've read around 6,000 books so far, plus perhaps 2,500 magazines a year, but, like everyone else, my retention of details is low. It would be nice to be able to quickly find the reference to a recent *Business Week* article on how much of a loss of income on the average we're going to have because the U.S. is changing to a service and sales economy instead of one based on manufacturing. I remember the general article, but time is gradually erasing the details.

Think how much more valuable magazines (and books) will be when we are able to easily search them with our computer for information. It'll be along, and when it comes I'll be one of the first users.

Speaking . . . no, writing about manufacturing going overseas, the new tax laws should substantially accelerate the movement of manufacturing to Asia—just what we need. This will then tend to reduce our overall income by about 40%. You see, the new tax laws have increased the taxes on business. Now if we weren't up against foreign competition, we could just go the old route and say what the hell and raise prices to pay the increased taxes. But there are fewer and fewer industries where we aren't in price competition with imports, so increased taxes will mean we'll have to move the manufacturing to lower-wage countries if we're going to stay in business. I believe we'll see business fleeing America faster than ever.

Moving taxes from people to business may feel good, but it's pernicious. The Japanese don't tax their businesses, which may help to explain how they are able to be so incredibly competitive, even with the yen increasing in value.

This is going to put pressure on even the small businessman to find an Asian partner in order to keep his costs of manufacturing down. I'll bet I'll be seeing more and more businessmen on the October Asian consumer electronic show tours in the next two or three years.

You say you disagree? Okay . . . let me know where you think I'm wrong. I sure wish I were, but it looks to me as if Congress is at it again, waving in the winds of election fever—a 365-day-a-year plague in Washington.

Let's not play the old "I don't always agree with you" tune. If you're going to be disagreeable, then sit down and send me your facts. Or do I have to start doubling the length of my editorials just to bludgeon you with the details which resulted in my conclusions? Yes, I know everyone is lazy and I'm a damned nuisance when I make you think. Hey, no one is holding your eyelids open and forcing you to read my editorial—that's just self-inflicted torture, so stop being disagreeable about it.

BIG RIG NEEDS HOME

I've got just what you Big-Gun DXers in Southern California will love—a ten-kilowatt sideband rig someone wants to give away for free. Does that make your little heart go pitty-pat?

The rig is a model GPT-10K, made by The Technical Materiel Corporation in Mamaroneck, New York. It's not exactly a brand new rig—manufactured in 1962—but it's a 2–28-MHz rig—imagine the fun you can have on 40m! Hey, no fair taking over WWV's channels, okay? This could make quite a dent on CB also, eh? Talk about real punch!

The rig is located in Southern California (naturally). It's a big mother—six-foot rack—must be near five feet wide—on wheels (whew!).

How to win it: The rig is available to any ham or ham club which can come up with a damned good reason for getting it. You'll have to go and get it—with a truck and some riggers. Write your rationalization for getting this rig on one page and send it to me. My decision (and that of the owner) will be final. No bribes, okay?

This rig, made for the Army, is built like all TMC gear, like a brick outhouse. It's a beaut! I remember their old GPR-90, the best HQ-129 ever built. TMC disappeared from the ham scene about the same time as everyone else, right after the Incentive Licensing disaster hit us. They sure did make fabulous radio equipment.

All that's needed to make this rig legal is a heavy shunt on the final plate meter. ■

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PROPAGATION

Number 23 on your Feedback card

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

Although the forecast for the last week of the month looks good at this time, there is always the possibility of a disturbed geomagnetic field due to unforeseen solar influences. In general, November looks as if it will support good HF propagation to all parts of the world except on the days noted. Note the trends. You may expect poorer conditions centering around the 3rd, the 13th, and the 23rd of the month.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G–F	3 F	4 F–P	5 P	6 F	7 G	8 G
9 G	10 G–F	11 F	12 F–P	13 P	14 P–F	15 F–G
16 G	17 G	18 G–F	19 F	20 G	21 F	22 P
23 P 30 G	24 F	25 G	26 G	27 G	28 G	29 G

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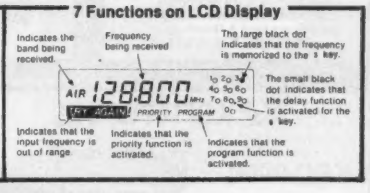
The Air-8 measures 3⅛" × 7⅛" × 2", and weighs just 21 oz. This is truly a sturdy little companion that will give you years of dependable performance wherever you go.

6 Frequency Bands

Band		Frequency range	Tuning interval
PSB		144 - 174 MHz	5 kHz
AIR		108 - 136 MHz	25 kHz
FM		76 - 108 MHz	50 kHz
AM	SW	1601 - 2194 kHz (1603 - 2194 kHz)	1 kHz
	MW	530 - 1600 kHz (531 - 1602 kHz)	10 kHz (9 kHz)
	LW	150 - 529 kHz (150 - 530 kHz)	1 kHz

7 Functions on LCD Display


Indicates the band being received.
Frequency being received
The large black dot indicates that the frequency is memorized to the 9 key.
The small black dot indicates that the delay function is activated for the 8 key.
AIR 128.800
KEY AGAIN
PRIORITY
PROGRAM
Indicates that the input frequency is out of range.
Indicates that the priority function is activated.
Indicates that the program function is activated.

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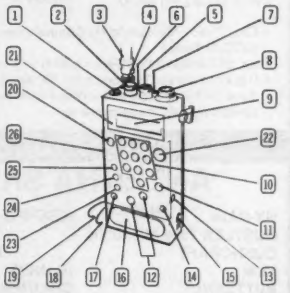

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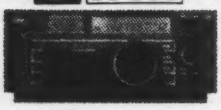

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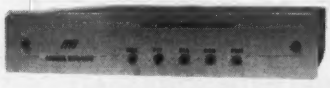

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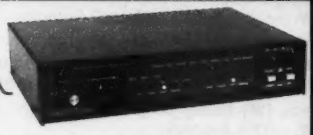

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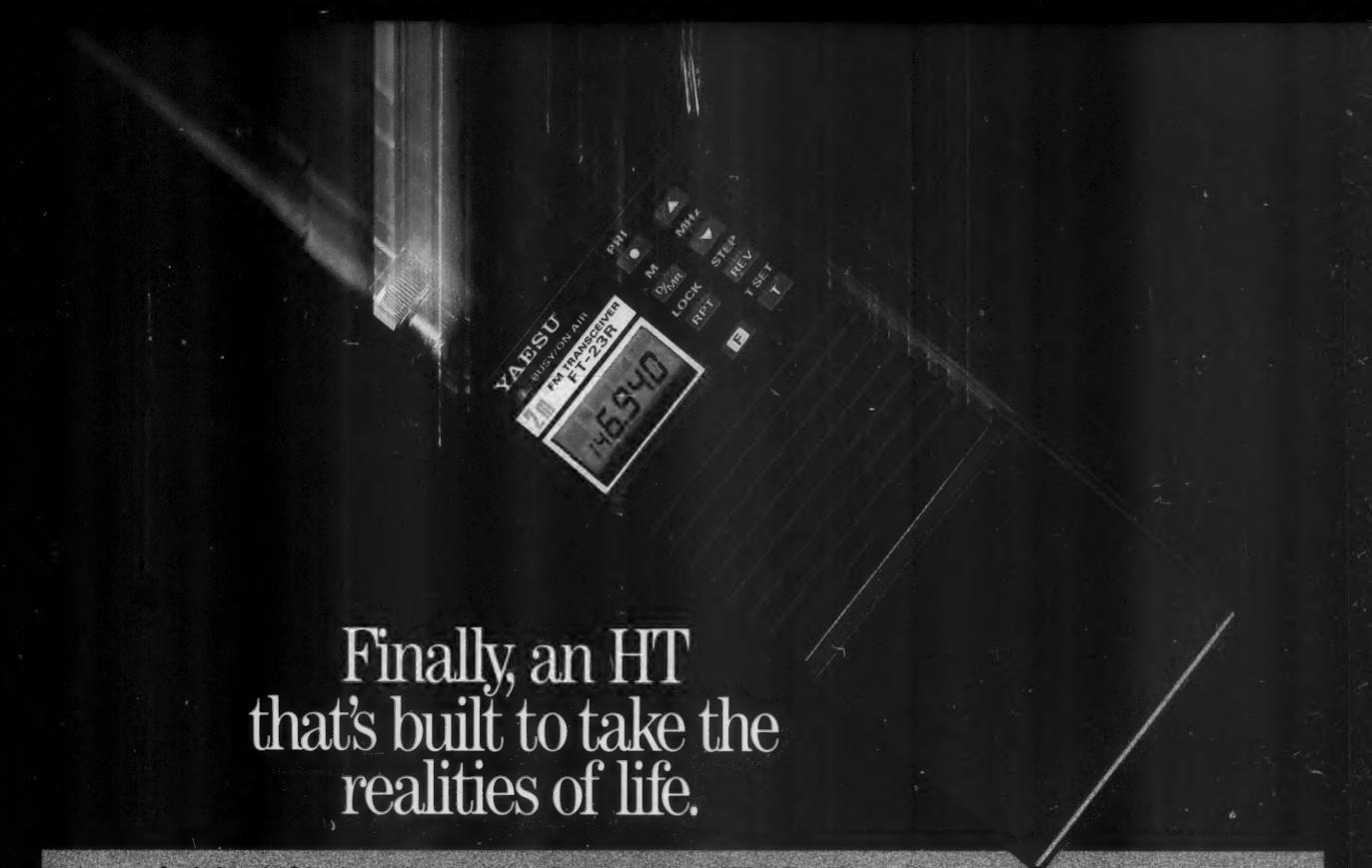

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Let's face it. It's easy to bump, drop, or get rain on an HT. ■ But if your HT is Yaesu's mini 2-meter FT-23R or 440-MHz FT-73R, such mishaps are a lot less worrisome. ■ They're built to last, with rugged aluminum-alloy cases that prove themselves reliable in a one-meter drop test onto solid concrete. Plus, their moisture-resistant seals really help keep the rain out.

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Radios above shown actual size.

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NEW

Hear it All!

R-5000

High performance receiver

***THE* high performance receiver is here from the leader in communications technology—the Kenwood R-5000. This all-band, all mode receiver has superior interference reduction circuits, and has been designed with the highest performance standards in mind. Listen to foreign music, news, and commentary. Tune in local police, fire, aircraft, weather, and other public service channels with the VC-20 VHF converter. All this excitement and more is yours with a Kenwood R-5000 receiver!**

- **Covers 100 kHz-30 MHz in 30 bands, with additional coverage from 108-174 MHz (with VC-20 converter installed).**
- **Superior dynamic range.** Exclusive Kenwood DynaMix™ system ensures an honest 102 dB dynamic range. (14 MHz, 500 Hz bandwidth, 50 kHz spacing.)

- **100 memory channels.** Store mode, frequency, antenna selection.
- **Voice synthesizer option.**
- **Computer control option.**
- **Extremely stable, dual digital VFOs.** Accurate to ±10 ppm over a wide temperature range.
- **Kenwood's superb interference reduction.** Optional filters further enhance selectivity. Dual noise blankers built-in.
- **Direct keyboard frequency entry.**

- **Versatile programmable scanning, with center-stop tuning.**
- **Choice of either high or low impedance antenna connections.**
- **Kenwood non-volatile operating system.** Lithium battery backs up memories; all functions remain intact even after lithium cell expires.
- **Power supply built-in.** Optional DCK-2 allows DC operation.
- **Selectable AGC, RF attenuator, record and headphone jacks, dual 24-hour clocks with timer, muting terminals, 120/220/240 VAC operation.**

Optional Accessories:

• VC-20 VHF converter for 108-174 MHz operation • YK-88A 1.6 kHz AM filter • YK-88S 2.4 kHz SSB filter • YK-88SN 1.8 kHz narrow SSB filter • YK-88C 500 Hz CW filter • YK-88CN 270 Hz narrow filter • DCK-2 DC power cable • HS-5, HS-6, HS-7 headphones • MB-430 mobile bracket • SP-430 external speaker • VS-1 voice synthesizer • IF-232C/IC-10 computer interface.

More information on the R-5000 and R-2000 is available from Authorized Kenwood Dealers.

R-2000 150 kHz-30 MHz in 30 bands • All modes • Digital VFOs tune in 50 Hz, 500 Hz, or 5 kHz steps • 10 memory channels • Programmable scanning • Dual 24-hour digital clocks, with timer • 3 built-in IF filters (CW filter optional) • All mode squelch, noise blanker, RF attenuator, AGC switch, S meter • 100/120/220/240 VAC operation • Record, phone jacks • Muting terminals • VC-10 optional VHF converter (108-174 MHz)

KENWOOD

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Specifications and prices are subject to change without notice or obligation.